THE

ELECTRICAL REVIEW.

VOL. LIV. MAY 20, 1904. No. 1,382.

ELECTRICAL REVIEW.

Vol. LIV.] CONTENTS: May 20, 1904. [No. 1,382.

	Page
Electricity Supply in Bulk	813
The Conductometer (*illus.*) (*continued*)	815
Telephone Negotiations and Wireless Regulations	817
Interesting Experience of a Cable Ship on the Amazon ...	817
Correspondence	817
National Electrical Manufacturers' Association's Dinner ...	821
Our Legal Query Column	822
Legal	822
Parliamentary	824
Business Notes	826
Leicester Corporation Electric Tramways (*illus.*)	832
Electrically-Driven Machines for Charging Gas Retorts (*illus.*)	836
Electricity Supply Accounts	841
City Notes	842
Stocks and Shares	844
Share List of Electrical Companies	845
Market Quotations	846
Electric Tramway and Railway Traffic Returns	846
Institution of Electrical Engineers:—	
Power Station Design (*illus.*) (*continued*)	847
Losses in Cable Sheaths	849
Dublin Section	849
Fuel Economy in Steam Plants	850
The International Printing Exhibition (*illus.*) (*concluded*) ...	850
Superheated Steam	851
Corporation Telephones (*illus.*)	851
Induction Coil Design (*illus.*)	853
Tramway Personnel	854
National Electrical Contractors' Association (Northern Section)	855
New Patents Applied For	856
Published Specifications	856

THE

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1904 Edition

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ELECTRICITY SUPPLY IN BULK.

THE case of Grenfell and Others *v.* the Directors of the South Lancashire Electric Traction and Power Co., a report of which appears in another column of the present issue, incidentally raises a question of great importance to those who are concerned with the supply of electricity for traction and power. The action was brought in respect of alleged misrepresentations in the prospectus of the defendant company whereby the plaintiffs were induced to underwrite certain debenture stock of the defendant company. It was stated in the prospectus that the defendant company was being formed to acquire the beneficial interest in, and to develop as parts of a single system, the rights of the South Lancashire Tramways Co. and the Lancashire Light Railways Co. The misrepresentation complained of was contained in a clause to this effect:—"The South Lancashire Tramways Co. is empowered by its Act to supply electric energy to local authorities for all purposes, and arrangements will be made accordingly. Such a supply can be given economically in conjunction with the tramway plant, thus securing a regular load on the stations for traction, light, and power, which will enable them to be worked on the most economical basis." Whether or not such power existed was, according to the case for the plaintiffs, a matter for great doubt. The question turned upon the construction of the Lancashire Tramways Act, 1900, by which power was given to construct and work certain tramways, the general purposes of the Act being traction. By Sec. 85 the company are not to supply electric energy for other purposes than the purposes of the Act without the consent of the local authority. It seemed that before issuing the prospectus, the directors had taken the opinion of Mr. Balfour Browne, K.C. After a protracted hearing, the jury found that the directors had taken reasonable precautions to ascertain that the statements in the prospectus were true, and judgement was accordingly entered for the defendants.

The incidental question to which we attach importance is whether an electric lighting or other company has the right to supply electricity to local authorities unless the necessary power is conferred by Act of Parliament. In other words, has an ordinary electric supply company the right to supply "in bulk?" It is true that the right to supply "in bulk" is specially conferred upon the so-called "bulk companies," but this does not exclude the exercise of that right by an ordinary company, if such powers are possessed by it.

It appears that ordinarily where undertakers (whether local authorities or companies) are authorised by provisional orders, they have no power to supply energy *outside* the authorised area of supply. Where, however, local authorities are authorised to supply electrical energy, Parliament is accustomed by Act to confer on them power to supply

energy in bulk to adjoining local authorities when the latter also possess supply powers. An ordinary form of clause is as follows :—"If the local authority for any district adjoining the area which the Corporation are for the time being authorised to supply with electric energy are, or shall be, authorised by provisional order confirmed by Parliament to supply energy, or if any company shall be authorised to supply energy in any such district, the Corporation and any such local authority or company may, with the approval of the Board of Trade, enter into and carry into effect agreements for the supply of electrical energy in bulk by the Corporation to such local authority or company." Such a clause was inserted in the Norwich Corporation (Electricity, &c.) Act, 1902 (2 Edw. 7, Ch. cliii., S. 20). There are some precedents enabling a company to supply outside their area in the case of tramways and railways. See, for instance, Hastings Tramways Act, 1900 (63 & 64 V., Ch. cxl., S. 84). This, however, is an exceptional case.

The foregoing statement of the law refers only to supply in bulk *outside* the authorised area. We have next to consider whether supply in bulk may be given within the area. Where local authorities are empowered to supply electrical energy, Parliament is accustomed to confer on them, by Act, powers to supply energy for traction purposes partly within and partly without their limits. A clause to this effect may be found in the Blackburn Corporation Act, 1901 (1 Edw. 7, Ch. ccxxiii).

Turning now to the general question, it is clear that by Sec. 19 of the Electric Lighting Act, 1882, undertakers are bound to supply electricity upon equitable terms to every company or person within their area. The term "company" means "any body of persons corporate or unincorporate." For our part we do not see why it should not include a local authority. As the law now stands, "general supply" by a company means the general supply of energy to ordinary consumers, and includes, unless otherwise agreed with the local authority, the general supply of energy to the public lamps, where the local authority are not themselves the undertakers. It may be, of course, that the maxim, "*expressum facit cessare tacitum*," applies; so as to exclude a local authority who are themselves authorised to supply from the definition; but the question is clearly arguable. Whatever doubts now exist with regard to ordinary supply companies would clearly be set at rest if the recommendations of Lord Cross's Committee are adopted. In answer to questions 4 and 5 (see Parliamentary Paper, 1898, No. 213), that Committee says :—"Where sufficient public advantage is shown, powers may be given for the supply of electrical energy over an area including districts of numerous local authorities, and involving plant of exceptional dimensions and high voltage. The Committee further think that undertakings of this character may properly be authorised on conditions differing in some respects from those imposed by and under the existing Acts."

It would seem that Parliament was animated by the spirit of this report in passing the Lancashire Electric Power Act of 1900, which provided that with certain exceptions the area of supply should be the County of Lancaster, and that the powers granted should be exercised only for the purpose of supplying energy to some general supply district, or to or on behalf of some local authority authorised by license, order, or special Act to supply energy within the area of supply, or to some company so authorised, and the company shall not, except for the purpose of obtaining convenient access to some such district, or to the area of supply of some such authority or company, exercise under the authority of this Act, any of the powers of the principal Act in reference to any street.

"Corporation Telephones."

On another page will be found an abstract of a paper with this quaint title and of the discussion on it, which together occupied two meetings of the Glasgow Local Section of the Institution of Electrical Engineers. As so often occurs with Institution papers, the discussion was by far the most valuable part of the proceedings. The discussion was uniformly a raking criticism of the subject matter of the paper; to some readers, unfamiliar with the technical details of telephony, it may seem that the critics were unduly severe. For our part we are glad the paper was so fully and ably discussed, as if it had been allowed to pass without such attention from those members competent to speak on the subject, our foreign friends would have conceived a strange idea of the technical progress of telephony in this country, and of the capacity of members of the Institution to deal with a branch of electrical engineering which has been brought to so highly scientific a pitch of perfection in other countries.

The paper shows so little grasp of the scientific side of telephony, and deals so superficially with a really important electrical industry, that the wonder is that it was accepted even by a local section. It has a certain value, nevertheless, as a record of what has really been done in the technical equipment of municipal telephone systems, of which we have heard so much regarding the financial side, but so little regarding the technical side. We now learn that although the first of the four municipal exchanges started building only four years ago, different methods of working have been adopted in bewildering variety. A municipal telephone subscriber does one thing in one part of Glasgow, a different thing in another part of the same town, still a different thing at Portsmouth, and yet another at Brighton. The error of adopting the call-wire system at Glasgow is now admitted, after three years' experience. One of the speakers remarked that the paper showed that municipal telephonists were learning telephony all over again. The reason given for abandoning the call-wire is that it has been discovered in Glasgow that office boys and servant girls use the telephone and make mistakes, so causing bad service. This remarkable discovery is naively attributed to the "vast extension of the telephone system which has followed the introduction of corporation telephones." It does not seem to occur to the author that the office boy has used the telephone since a telephone was first put in an office, or that the domestic servant has used the telephone since a telephone was first put in a private house.

Nor are these by any means the only people who make mistakes, if the method of working makes mistakes easy. Business men of great respectability will not only forget to press buttons and to call off, but often bluntly refuse to be bothered with trying to remember to do so; and women, unless specially trained as workers, can never be relied upon consistently to perform mechanical operations—it is not in woman's nature. These are the very reasons, well-known long before the vast extension of corporation telephones began to take its flight, why telephone systems with buttons, cranks and call-wire entanglements were superseded by automatic signalling systems the moment that an all-round efficient automatic signalling system was perfected—now a matter of ten years ago. Curiously enough, the automatic signalling, now generally recognised as one of its most valuable features, was to a certain extent a bye-product of the common battery, which was originally designed chiefly to do away with the individual battery of each transmitter. Towards the common battery the author of "Corporation Telephones" displays a curious attitude of unenlightened reaction. It is apparent that this is not based upon personal experience

and observation, barring an occasional call, but upon that kind of prejudice which is born of strangeness. Against the mass of evidence brought from all countries, the only reply is vague talk of "complexity" and loose second-hand statements of people who have sought a change of situation.

Mr. Gill seems to have hit the nail on the head by contrasting the standard practice of other telephone systems with the varying practice exhibited in municipal telephone systems during their short history of three years. "Corporation telephones" are the subject of fresh experiments at each place, and the Glasgow system, built three years ago, is still in an experimental stage. On the other hand, common battery systems put in five years ago are up to date to-day, and are standard with installations now being constructed by experienced telephone engineers in large cities all over the world. Some day the corporations which have adopted the backward methods described in the paper, will be obliged to reconstruct their systems on modern lines, and will then have to pay for their original mistakes.

The Purchase of a Tramway Undertaking.

A CASE which was recently heard by Mr. Justice Channell in the King's Bench Division, and is reported elsewhere in this issue, illustrates the kind of disputes which may arise between local authorities and companies in connection with the compulsory purchase of tramway undertakings. It appears that the Swinton and Pendlebury Urban District Council recently sought to take over the undertaking of the Manchester Carriage and Tramway Co., or so much thereof as was within its district. A dispute having arisen as to the price to be paid, the matter was referred to the late Sir Frederick Bramwell. It appeared that there were two depôts, both outside the district of the Council, and the question was whether the Council could be forced to take over any part of the undertaking which was so situated. Section 43 of the Tramways Act provides that:—

> Where the promoters of a tramway in a district are not the local authority, the local authority . . . . may (within certain specified times) . . . . by notice in writing require such promoters to sell, and thereupon such promoters shall sell to them their undertaking, or so much of the same as is within such district, upon terms of paying the then value . . . . of the tramway, and all lands, buildings, works, materials and plant of the promoters suitable to, and used by, them for the purposes of their undertaking within such district.

Sir Frederick Bramwell found that only one of the depôts was "suitable to and used with" the undertaking, and he made an award to the effect that only this depôt need be acquired. He stated a special case for the opinion of the Court, the question being whether the words "within such district," as used in the above section qualified the word "undertaking," so that a depôt situated outside the Council's district, but suitable to, and used for the purposes of such part of the undertaking as was within such district was to be taken and paid for by the Council. Mr. Justice Channell said he felt bound by the findings of the special case, but, that if Sir Frederick Bramwell had been still alive, he would have felt inclined to send it back to him. He continued:—

> Assuming that the depôt was "then" suitable to, and used by, the tramway company for the purposes of their "undertaking," I think the Council are bound to pay for it, and to purchase it. The words in the section "within the district," apply to the "undertaking," and not to "lands, buildings, works, materials, and plant," because some things, such as horses, are movable, and are sometimes within and sometimes without the district.

In the event, however, he felt compelled to uphold the award, but gave leave to appeal.

It would appear to be only just that a district council or other local authority, when exercising the power of compulsory purchase, should be compelled to take over its due proportion of the property in which the capital of the tramway company is invested. Tramway undertakers do not build depôts for amusement, and their only reason for going outside their district is to obtain a less expensive site. The case is one of considerable importance, for although it related to the compulsory purchase of a horse tramway, the 43rd section of the Tramways Act applies with equal force to electric tramways.

THE CONDUCTOMETER.

By ROLLO APPLEYARD.

(Continued from page 810.)

PROVIDED (1) that the standard wire corresponds to 100 per cent., and provided (2) that all the test wires are of equal diameter, a slide-bridge, fitted with such a scale, would do the work. In my paper (Inst.C.E., l.c.) I gave several methods for overcoming difficulties arising from a standard wire being other than 100 per cent.; one of the methods consisted in making an appropriate change in the length of the standard wire. This, however, involves a certain amount of arithmetic and manipulative skill. It is quite practicable to use resistance coils or wires of the exact resistance values, or resistance coils corrected by shunts, to correspond to 100 per cent. for the particular diameter of wire under test. But, with a conductometer, the standard wire may differ from 100 per cent. conductivity, and an allowance may be made for the difference instantly, by moving the conductivity scale itself, with reference to the electrical middle of the bridge-wire, through a number of divisions representing the difference of percentage conductivity between the standard wire and 100 per cent. This will be understood from fig. 1 (p. 816), which is a diagrammatic representation of the scales of the conductometer. The electrical connections are made exactly like those of the ordinary slide-bridge. In fig. 1 the bridge-wire, S S, is supposed to be divided into 100 equal parts, as shown by the scale P P. The scale P P is, however, merely for reference in the diagram, and does not exist in the actual conductometer. Scale B B is the conductivity scale, each division of which, as above explained, is 0·25 of a division of P P; it is marked 100 at its middle point. The bridge-wire, S S, may be of any convenient length, say, 2 metres, so as to obtain bold scale divisions. But as only a few centimetres of S S are ever traversed by the slider, the ends are coiled away near together inside the case, for compactness, and to reduce temperature differences. The block, M, is a brass piece carrying a mark, which is set once for all at the electrical middle of S S. The compensation for the conductivity of the standard wire is effected by sliding B B with reference to M, so that the line on M is opposite to the position on B B, representing the percentage conductivity of the standard wire. The scale, B B, is clamped there so long as that particular standard is in use. This operation involves no complexity whatever. It will presently be seen that appropriate settings of the scale, B B, also enable a single standard wire or coil to be used as a standard for several near sizes of wire.

The greatest difficulty with conductivity tests is to compensate for differences of diameter or mass between successive test wires. I have solved this in the conductometer by the use of a *diameter* scale. Let d be the diameter of the standard wire, and let $(d + y)$ be the diameter of the test wire. Then, from equation (2)—

$$\frac{100 - \mathrm{L}}{d^2} = \frac{\mathrm{L}}{(d+y)^2}$$

$$\therefore \mathrm{L} = \frac{100\,d^2 + 200\,dy + 100\,y^2}{2\,d^2 + 2\,dy + y^2} \qquad (4)$$

$$\therefore \mathrm{L} = 50 + 50\,\frac{y}{d} - 25\left(\frac{y}{d}\right)^2 + \frac{25}{2}\left(\frac{y}{d}\right)^4 - \&c.$$

In this progression, by referring to fig. 1, we see that the first term, 50, is the middle of the bridge-wire S S. It follows, therefore, that the sum of all terms after the first is, what I prefer to call the "deviation" of the slider, *i.e.*, the displacement from the middle of the bridge-wire, on account of the small difference y.

The "deviation," V, is consequently given by—

$$\mathrm{V} = (\mathrm{L} - 50) = \frac{100\,d^2 + 200\,dy + 100\,y^2}{2\,d^2 + 2\,dy + y^2} - 50. \qquad (5)$$

This is a perfectly general equation, provided that d and y are expressed in the same unit. Let us suppose them expressed in mils. We can now find the change in L corre-

sponding to a change of 1 mil in d. For if in equation (5) we put $y = 1$, we have—

$$v = 50 \frac{(2d + 1)}{(d + 1)^2 + d^2}. \qquad (6)$$

Here v is in scale-divisions, each division being $\frac{1}{100}$th of the length of the bridge-wire. By giving d, in equation (6), successive values, say, from 10 mils to 225 mils, a curve (Curve I.), can be plotted which will show the proper scale-setting by which to compensate for the 1 mil difference in diameter between the test-wire and a standard wire for any value of d. Curve I. is drawn in accordance with the table attached. With the ordinary micrometer it is usual to estimate to $\frac{1}{10}$th mil; it is, therefore, convenient to take one-tenth of the value given for the scale-setting, v, by the curve or table, and to multiply this one-tenth value by all whole numbers from 2 to 9. This is the only arithmetical work demanded. We are then able to compensate for any fraction of a mil for that nominal gauge of wire. The way in which this compensation is applied can be understood from fig. 1. The scale A A is divided into hundredths of P P. It is marked "0" in the middle. The contact key, K, has a central mark upon its frame in line with its contact point. The key, K, can slide against the scale, A A, and can be clamped at any point along A A. When so clamped, the scale, A A, and the key, K, traverse together, so that A A then slides against the "conductivity scale," B B, which we may suppose has already been appropriately set and clamped in reference to M. According then as the successive test-wires are greater or less in diameter than the nominal gauge of the standard, the key, K, is set with reference to the "diameter scale," A A, by an amount equal to the "deviation" as above defined, to right or left of the zero of the scale, A A. The conductivity per cent. is finally read off upon B B at the zero mark of A A.

It is well to observe that the divisions of scale B B (fig. 1) corresponding to unit change in percentage conductivity are $\frac{1}{4}$th the length of the divisions of scale A A. Consequently a given error in calculating or adjusting the "deviation," expressed in scale-divisions of A A, corresponds numerically to a change four times as great in percentage conductivity. This consideration will enable a check to be applied as to the accuracy of the instrument. For example, referring to Curve I., we see that the "deviation" per mil for 28 mils is 1·75. A 1-mil error in gauging a 28-mil wire results therefore in an error of 1·75 divisions on P P, *i.e.*, it represents an error of $1{\cdot}75 \times 4 = 7$ per cent. conductivity.

In order to indicate the degree of accuracy that can be obtained by micrometer gauge measurements, 30 ft. of copper wire of about 44 mils diameter was gauged in 64 places by an observer (A) and in 66 places by an observer (B).

The average of the 130 gaugings was 43·6375 mils.

					Mils.
Greatest difference in A's gaugings in vertical plane					= 44·2 − 43·1 = 1·1
"	"	B's	"	" "	= 44·6 − 43·0 = 1·6
"	"	A's	"	horizontal "	= 44·0 − 43·2 = 0·8
"	"	B's	"	" "	= 44·2 − 43·1 = 1·1
Mean of all	...	A's	"	for both planes	= 43·680
"	...	B's	"	" "	= 43·595

Difference of A's and B's average gaugings = 0·085.

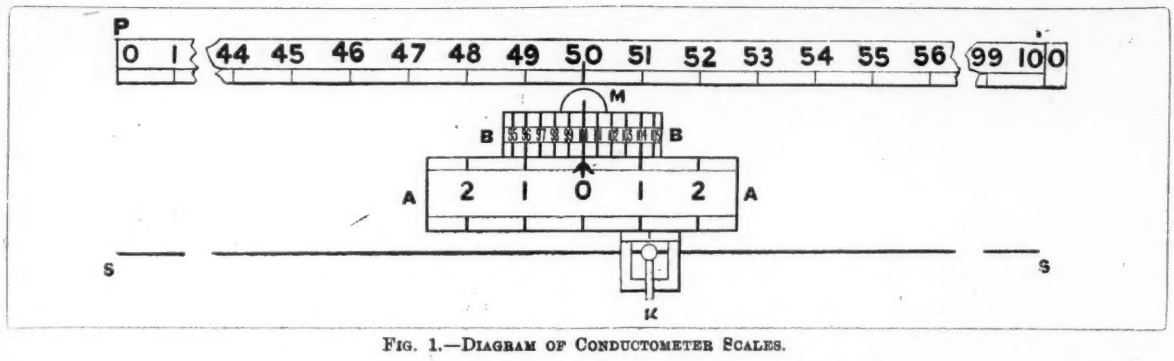
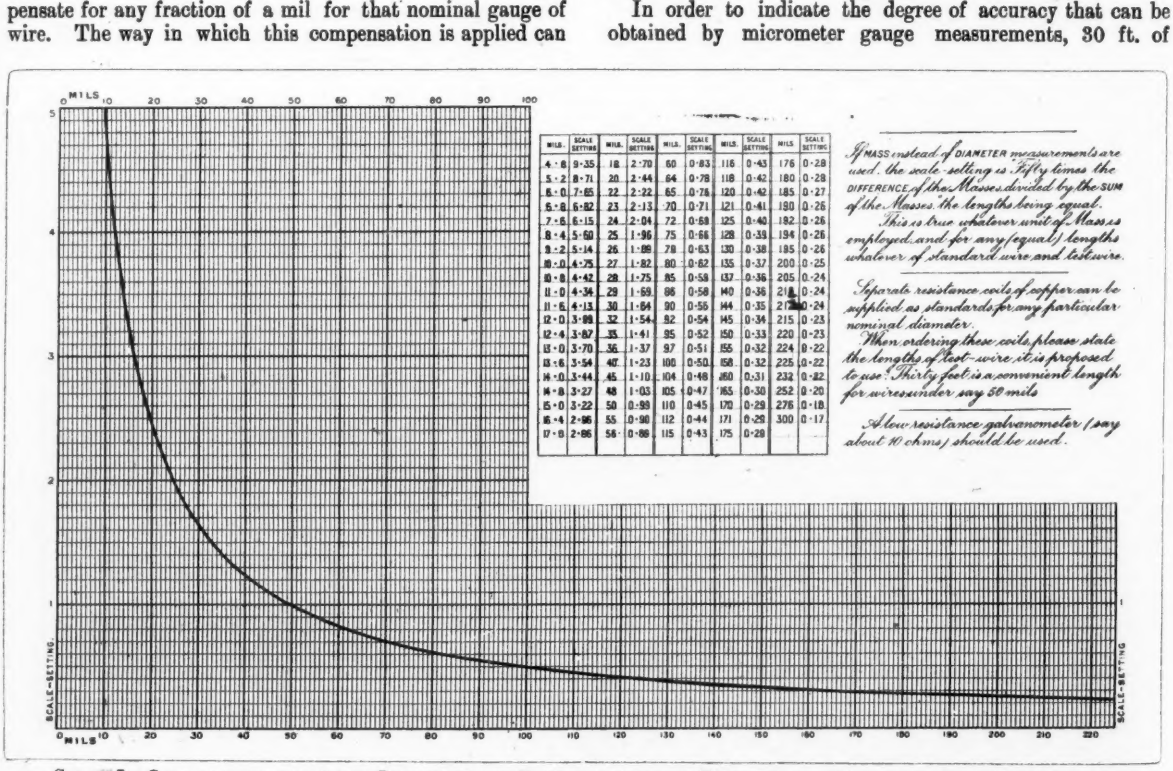


Fig. 1.—Diagram of Conductometer Scales.


MILS
SCALE-SETTING
MILS
If MASS instead of DIAMETER measurements are used, the scale-setting is fifty times the DIFFERENCE of the Masses divided by the SUM of the Masses, the lengths being equal.
This is true whatever unit of Mass is employed, and for any (equal) lengths whatever of standard wire and test-wire.
Separate resistance coils of copper can be supplied as standards for any particular nominal diameter.
When ordering these coils please state the lengths of test-wire it is proposed to use. Thirty feet is a convenient length for wires under say 80 mils.
A low-resistance galvanometer (say about 10 ohms) should be used.

MILS.	SCALE SETTING	MILS.	SCALE SETTING	MILS.	SCALE SETTING	MILS.	SCALE SETTING	MILS.	SCALE SETTING
4·8	9·35	18	2·70	60	0·83	116	0·43	176	0·28
5·2	8·71	20	2·44	64	0·78	118	0·42	180	0·28
5·6	7·65	22	2·22	65	0·78	120	0·42	185	0·27
5·8	6·82	23	2·13	70	0·71	121	0·41	190	0·26
7·6	6·15	24	2·04	72	0·68	125	0·40	192	0·26
8·4	5·50	25	1·96	75	0·66	128	0·39	194	0·26
9·2	5·14	26	1·89	78	0·63	130	0·38	195	0·26
10·0	4·75	27	1·82	80	0·62	135	0·37	200	0·25
10·8	4·42	28	1·75	85	0·58	137	0·36	205	0·24
11·0	4·34	29	1·69	86	0·58	140	0·36	210	0·24
11·6	4·13	30	1·64	90	0·55	144	0·35	212	0·24
12·0	3·98	32	1·54	92	0·54	145	0·34	215	0·23
12·4	3·87	35	1·41	95	0·52	150	0·33	220	0·23
13·0	3·70	36	1·37	97	0·51	155	0·32	224	0·22
13·6	3·54	40	1·23	100	0·50	158	0·32	225	0·22
14·0	3·44	45	1·10	104	0·48	160	0·31	232	0·22
14·8	3·27	48	1·03	105	0·47	165	0·30	252	0·20
15·0	3·22	50	0·99	110	0·45	170	0·29	276	0·18
15·4	2·96	55	0·90	112	0·44	171	0·29	300	0·17
17·8	2·86	56	0·88	115	0·43	175	0·28		

Curve I.—Scale-setting for 1 mil Difference in Diameter between Test-wire and Standard-wire: The Nominal Diameter being here stated in Mils.

The chances are, therefore, that even with careful gauging of copper wire we are likely to make an error of about 0·1 mil. These diameter errors, of course, exist, whatever electrical apparatus may be employed for determining conductivity by the *diameter* method.

The 44-mil wire just referred to was gauged just as it was unwound from a fairly good hank, and was not straightened in any way. With a view to ascertaining the effect of straightening the wire, it was re-gauged after passing it through a cloth held in the hand with just enough pressure to remove the bends. The average of 115 gaugings taken after this process, showed that the change in *d* due to this handling was 0·34 mil. This corresponds to an error of about 1·5 per cent. conductivity. In practice, the wires are generally straightened before and not after gauging; this latter error is therefore avoided. The figures, however, indicate that gaugings should be taken while the wires are on the testing bench. There is another important item to be considered in carrying out this part of the work, and that is the labour involved in stacking and moving these heavy hanks of copper wire. If the gauging is left for subsequent measurement, this would almost certainly involve additional time and labour, and the fact of winding-up and unwinding the hank, and straightening a length sufficiently for gauging, might introduce error.

(*To be concluded.*)

TELEPHONE NEGOTIATIONS AND WIRELESS REGULATIONS.

In the House of Commons on the 12th inst. Lord Stanley, in the course of a statement in Committee on the Post Office service, said :—

For many reasons he was glad that the telephone discussion had been postponed. Later in the session he hoped to give more definite information to the House as to the progress of the negotiations with the Telephone Co., and as to the future organisation and administration of wireless telegraphy. He hoped that he should be able to assure the House that the Post Office were arriving at a conclusion which would prevent the growing up in this country of a monopoly such as there had been experience of in the past. At the same time, he should be able to show that he was not dealing unfairly with those who had made wireless telegraphy a possibility.

This statement of Lord Stanley's seems to confirm the information published in the *St. James's Gazette* of the same afternoon that the Telephone negotiations were in an advanced state. And this notwithstanding that the company had asked more than the Postmaster-General saw his way to advise the Government to pay. But there was no question of a deadlock; the negotiations were proceeding smoothly, with every prospect of an early settlement. In his reference to wireless telegraphy, Lord Stanley was apparently suggesting that the lesson of experience with the Telephone Co. should serve to prevent the growth of another monopoly of another kind. There are differences, of course, in the conditions of the respective services.

INTERESTING EXPERIENCE OF A CABLE SHIP ON THE AMAZON.

A correspondent sends us the following account of a strange experience recently undergone by the telegraph steamer *Viking*, during a repair to one of the cables in the River Amazon :—

"A fault having broken out, and having been localised at a spot where the cable was laid in one of the numerous side streams or 'paranas,' out of the strong current of the main river, the *Viking* proceeded to its repair.

"After grappling for some time without success, she moved about a mile down stream. Here the channel passed close under a fringe of high trees which seemed a favourable position for hooking the cable. The first drag proved the surmise to be correct, and the bight having been duly lifted and cut, one end was buoyed, and picking up commenced towards the fault. Half a mile or so had been recovered when the cable left the open water and led right into the coarse grass, called capim, which everywhere fringes the low-lying banks of the Amazon, and which frequently floats in immense masses on the surface of deep water reminding one very much of the "sud" on the Upper Nile.

"In this instance there was 12 ft. of water alongside it, and picking up was continued in the hopes of being able to pull the ship through to the other side, distant about a mile. The situation was certainly novel, and soon difficulties arose. The circulating pumps got choked with grass, and to make matters worse, water had to be supplied to the boilers, to enable the picking-up machine to be worked, by means of a suction hose put over the side and connected to a hand pump. Gradually, as the vessel proceeded, the grass in front became more and more compact until the cable led up and down, and it was obviously necessary to cut away the obstruction. A couple of hour's work by all available hands armed with knives, choppers, and other cutting implements cleared a way for the cable and the bow of the ship, and the machinery was again started. Before long, however, the neighbourhood of suspicious looking young trees was reached, and the ship became stationary. On making a hole through the grass and pushing down a pole, 9 ft. of water was found, and this being 1 ft. less than the ship could float in, the cable was accordingly cut, just above the surface of the grass. The end remained sticking up, and appeared to have no inclination to retire from view.

"Over half a mile had been picked up, and but for the shoal water doubtless the whole length would have been recovered, and a somewhat bold proceeding justified by complete success.

"Pulling a ship along by means of a good strong cable is one thing, warping her back, stern first, by running out Kedge anchors, is quite another. Grass had closed up behind, leaving only a narrow channel barely sufficient to permit the passage of a boat. The first Kedge anchor promptly came home without the ship showing any signs of moving. A heavy grapnel was next banked behind the anchor, but these two proved insufficient, and matters began to look serious. As another resource grapnels were now run out over the bow, carried along the grass to the stern of the ship, and hooked deeply into the impeding mass, which was then hauled forward with the winch. The excitement of falling into holes was varied by a snake hunt and the killing of a fine specimen about 8 ft. long. After a few of these novel drags had been made and the stern cleared, the ship began to move, and gradually left behind a compact mass of grass and weed, which appeared almost solid, and which had extended from the bow to about midships. By this time it was dusk, and work had to be abandoned. Myriads of young mosquitos now appeared, giving us a pretty good idea of what our experience would have been had the season been a little more advanced, and their biting powers fully developed. In the early morning, the engineers having made the necessary alterations, and cleared the propellors of grass, the ship was worked out, using the high-pressure cylinders only; and the choked pumps having been cleared, cable work was resumed, and the repair duly completed. A considerable length of cable had to be abandoned. The channel has completely changed, and where four or five years ago 14 ft. of water existed is now an island with fair-sized trees. Under this the cable goes, and it is too deeply buried to be recovered."

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week.

Recent Developments in Metal Conduit for Electric Light Installations.

The writer of the above article, Mr. L. M. Waterhouse, waxes very wrath in reference to our letter which appeared in your issue of the 6th inst., and in which we made some criticisms on his article. Surely the writer should have headed his article "Recent Improvements in Simplex Conduits." We certainly said nothing about an unfair advantage. We said, no one would begrudge him the advertisement. Had it not been for his misleading

statement in reference to Mr. Bathurst ceasing his connection with lined tubes, we should certainly have taken no notice of it.

Mr. Waterhouse tries to explain away his reference to Mr. Bathurst by saying he simply gave credit where it was due, but we most cordially agreed with this in our last letter.

The misleading statement we referred to was this: That the introduction of lined tubes was mainly due to the efforts of Mr. Bathurst, *but that it would be some satisfaction to those who had devoted their attention to ordinary conduit to know that shortly before his death, he severed his connection with lined conduits and devoted his attention to perfecting a system of plain tubes.* Would not this lead anyone to infer that he, who was the most influential authority and enthusiast in the insulated conduit business, changed his opinion in favour of unlined conduit?

Your correspondent, Mr. W. H. Isherwood, throws quite a different light on this matter. He says Mr. Bathurst wrote that theoretical ideals of perfection in wiring must give way to the exigencies of commercial requirements, *i.e.*, something cheaper. This is altogether another thing. Many a good man has had to throw over, or let drop, a good invention which probably came before its time, for lack of an appreciative public, or because its cost was prohibitive.

An example of an unappreciated invention of recent times would be present in everyone's mind, viz., the Parsons steam turbine. It must be remembered that patents at one time considered prohibitive in cost, are often taken up later on, after further developments in that particular line have taken place, or a cheaper method of production could be adopted. Your correspondent appears to think that no conduit would have had a chance but for Simplex; but, while Simplex has developed a demand for light conduits, as opposed to wood casing, others have been pressing the use and sale of heavier screwed conduits.

From Mr. Waterhouse's remarks, we inferred he was opposed to lined conduits, and now that he has "declared his hand," we find that our inference was quite correct, which somewhat clears the air. The relative cost of insulated tubing and unlined solid-drawn steel tubes is about ¾d. per foot on ordinary sizes in favour of the unlined conduit, for does not Mr. Waterhouse himself admit that welded tube is not an ideal one for wiring purposes?

We may say that the lining of insulated conduits, as made at the present day, with improved machinery, would not absorb more moisture than hard rubber, or any other waterproof material. Almost any material will absorb moisture if immersed in water, but we might suggest that steel conduits are seldom laid in water.

"If tubes are not cut square, as is often the case in erecting, how can continuity be relied upon, and is not the strength of the chain limited to the strength of its weakest link?" We may say that we square the ends of all tubes in our shops, and if cut in erecting, we provide tools for squaring on the job, which are as easy to use as screwing tackle. If the workman does not use his tools, that is not our fault. It would be foolish to condemn a good system on this account. We might as well condemn a steam engine because a workman might forget to screw up a nut on a piston head and thus run the risk of knocking out the cylinder cover, or, to come nearer home, condemn a conduit system because a workman might omit to scrape the enamel from the end of a tube, or screw up the split nut used in connection with a "certain new earthing device"—which, by the way, we seem to have seen quite a long time ago, in a slightly different form.

With reference to the strength of chains being limited to the strength of the weakest link, if Mr. Waterhouse will refer to his text-book on the subject, we think he will find it so stated therein. The advantage of tube insulation lies in preventing the leakage of current to the tube. We may say that, with a properly erected system of lined tubes, tests quite equal to those obtained with wood casing can be obtained—a result not always obtainable in unlined tubes. As we said in our last letter, if the insulating medium is inserted in such a manner that it forms a perfect contact with the interior of the tube, it will prevent any creeping of moisture between the insulation and the tube. The insulating medium being a non-conductor of heat, prevents any sudden temperature changes in the tube, and thus prevents any appreciable condensation.

For cheap wiring, there is no doubt a large field for light cheap tubes, for, naturally, every central station engineer wants to get as many lamps on as possible, and for ordinary house work something must be done to reduce the initial cost, but we are of opinion that for good work, some people are apt to lay too much weight on initial cost. Good material and good work have to be paid for, and if more were thought of these two items and less of initial cost, there would be less complaint of continual expenditure for repairs and less talk of the vagaries of the electric light so often indulged in by the non-technical press and the gas journals. One thing is certain, and that is, we shall never get a system of wiring that can be thrown together, and it would, in our opinion, be far better if more attention were paid to educating the workman and getting him to be more conscientious, rather than excusing him and pandering to his incompetence. Hot water and steam work have to be well done to last, and why the electrical trade should rest continually under the stigma of bad workmen we cannot understand. We may inform Mr. Isherwood that this company did not withdraw its system of unlined conduit from the market, and whatever might have been its effect on the sale of lined tubes at the time referred to by Mr. Isherwood, we find it does not interfere at all with the sale of insulated tubes at the present time. There are plenty of situations favourable to unlined conduit wiring where the cost of the other system is prohibitive, and for this purpose we advocate solid drawn steel tubes. To these two systems we intend to devote our attention, leaving the cheaper field to others, being quite assured that where good work is required, and where the money is available, the best is in the end the cheapest.

The Conduit and Insulation Co., Ltd.,
A. E. Woodyer.

Summer's Town, London, *May 10th*, 1904.

We also read Mr. Waterhouse's article on the above subject, in your issue of April 1st, but in that article we found nothing we had not heard before, and nothing quite new, so far as Mr. Waterhouse is concerned. We must thank him for his kindly reference to the late Mr. Fred Bathurst, our predecessor in Armorduct conduit, and his kindly reference to that material. We did, of course, not expect Mr. Waterhouse to make it "Armorduct or wireduct," any more than we would think of making it "wireduct or Armorduct" were we to write on the subject.

We believe we are safe in saying that wireduct was brought out to meet a demand which Armorduct created. We know, indeed, very little about that material, but we have heard it called a cheap imitation, both in name and quality.

Mr. A. E. Woodyer, in his criticism in your issue of the 29th ult., takes objection to Mr. Waterhouse's reference to Mr. Bathurst. We do not find Mr. Waterhouse's reference to Mr. Bathurst improper in any way; in fact, he (Mr. W.) may be correct in assuming that Mr. Bathurst came to the conclusion that conduits with an insulating lining were not the correct article for our existing system of wiring.

In this connection it is interesting to refer to Mr. Bathurst's "Electric Wiring Methods of To-day," published in the Electrical Review, April 11th, 1902. Mr. Bathurst there made his opinion clear on the question of insulated conduits, as compared with uninsulated conduits, pointing out that with our present two-wire system, an insulated conduit is not only unnecessary, but is an obstacle in the way of the development of conduit wiring. Mr. Bathurst's opinion that the ultimate solution of the conduit-wiring question will be "accessible concentric wiring, consisting of a bare copper wire inside an interiorly insulated pipe, or an insulated copper wire inside a suitable protecting metallic conduit" is our own.

Our present two-wire system requires for "high class" installation work, namely, for work in which efficiency is not sacrificed altogether for low first cost, welded or solid drawn tubes suitably finished as electrical conduits, and developed as a proper screwed system throughout.

With brazed conduits, the screwing question is an exceedingly difficult one, as it is practically impossible to secure a brazed pipe joint which will withstand a die. We have the opinion of numerous contractors of great experience

in screwed conduit work on that question. In further support of this statement, we need only ask why, to-day, by far the larger percentage of screwed conduit is welded or solid drawn?

Consulting engineers who move with the times, and conscientious contractors who have the development of the conduit-wiring question generally at heart, to-day specify and use respectively welded conduits in preference to brazed or solid drawn conduits—in the case of the former owing to the unsatisfactory working qualities, and, in the case of the latter, owing to excessive cost. (Solid drawn conduits cannot, to-day, be produced at a competitive price in a quality which is satisfactory for conduit wiring.)

It is indeed hard, if not impossible (and certainly useless), to compare a high class welded, screwed conduit system with an open joint tube system of the Simplex or any other type, and we have never attempted to do so; would Mr. Waterhouse compare a 25s. ready-made suit with a tailor-made garment? There is no comparison between the two. Close joint tubing answers one purpose, and high grade, welded steel conduit answers another, but we have our doubts that close joint tubing answers some of the purposes which Mr. Waterhouse seems to think it is suitable for. We do not look upon close joint tubing as useless—for certain work it is no doubt quite satisfactory—but we cannot look upon it as the material in which the ultimate solution of the wiring question is to be found.

Makeshift earthing devices do not come to us as a surprise, they come as a natural consequence of the situation—close joint tube makers would naturally look for some means of surmounting, what is to-day, a serious obstacle in the way of their sales. But, we believe makeshift earthing devices have not met with favour, and are not likely to do so in the future. It is our conviction that there is nothing in between a proper screwed-conduit-system and the socket-joint-system still in use.

The conditions obtaining to-day ask for high-grade welded steel conduits, which, we think, should combine the following advantages; they should be manufactured from high-grade mild steel, of such bending qualities as to admit of bending freely on the spot; the process of manufacture should be such—and importance is to be attached to this point—as to guarantee a perfectly smooth interior. The importance of a thoroughly suitable enamel, as compared with the japans and lacquers still in use with most conduit systems, cannot be over-estimated. Conduit tubes should be *fire*-enamelled with an insulating, acid and moisture proof enamel which will preserve the metal from rust and oxidation, and, which will not be attacked by the acids and alkalies contained in plasters and cements, and such enamel should be thoroughly flexible so as to remain intact when the tube is bent and under the wireman's tools. Finally, we believe the present day method of employing an enormous number of fittings of various kinds and descriptions, is a serious obstacle in the way of the development of conduit wiring, as they afford increased scope for the careless workman, and are a direct obstacle in the way of a proper drawing-in system, which, we believe, can be obtained only by the use of suitable junction boxes, of such design as to lend themselves to the use of the various outlet fittings employed for general wiring work.

In this connection we think it is only fair to ourselves to mention that the conduit system which the late Mr. Fred. Bathurst worked upon before his untimely death, has been completed, and we believe the Armorduct system combines the advantages which a suitable conduit should possess.

The Armorduct Manufacturing Co., Ltd.,
W. Schmahl, *Governing Director.*

6, Farringdon Avenue, E.C.,
May 3rd, 1904.

May I be permitted to add a few remarks on the above subject, having had some experience in both the manufacture and sale of conduits.

I should like to be able to declare myself unprejudiced in the matter, but though this is impossible, I may say that my present position behoves me to be careful in criticising systems other than that with which I have had principally to deal up to the present.

My remarks are inspired by a careful perusal of the previous correspondence on this subject, and also an intimate knowledge of the requirements of the trade. Should anyone be curious to know my present connection with the trade, they can follow the example already set them in this discussion and transpose my initials for the information.

I agree with Mr. Woodyer's remark that "the best is the cheapest," but should like to suggest that the dearest is not necessarily the best. Price is in most cases the ruling factor in present day conduit wiring, and despite the claims that age may give to a particular system, I have not found the trade very conservative if the price of a newer system is less.

It is also generally admitted that it is not so much the price of the conduits as the fittings which affects the cost of a job, especially in private house work and in buildings where the proportion of elbows, tees, &c., to feet of tube is high.

It is this problem of the economical production of fittings which is engaging the attention of conduit engineers at the present time; and as it has been found possible by the employment of improved machinery to materially reduce the cost of these articles, it behoves the contractor to go very carefully into the price he is paying for the conduit accessories, and whilst not sacrificing quality to low price, to give his custom to the firm which combines the two.

It is to this end, and with the idea of stimulating the manufacturer to continuous efforts, that the consulting engineer refrains from putting any particular make of conduit in his specification. Or, if he does mention a particular system, leaves a loophole which admits of other makes being used.

This question takes us back to conduits once more, for Mr. Waterhouse, in his original article, when comparing screwed brazed conduit with wireduct, or Armorduct, remarks, "Although the cost of the former is higher in comparison with either of the others, owing to its process of manufacture, screwed brazed conduit has advantages which more than counterbalance its increased cost." The advantages which he goes on to enumerate, show it to be so eminently desirable from the standpoint of efficiency, that the trade will be pleased to hear what Mr. Waterhouse is evidently unaware of, viz., "That improvements in the process of manufacture" of screwed brazed conduit now enable it to be produced at an equal price to either of the others mentioned.

C. E. Gunner.

With reference to Mr. Rawley's letter in your last issue, I am inclined to think that he has never used a good insulating conduit, and with all his undoubted experience I think he still needs a lesson in conduit wiring.

It would be interesting to know whether he really used an insulating conduit or an imitation of this material. The writer in practical experience has met with both the real and the imitation. With one class I found that when drawing through the conductors from one end, the insulation either choked up inside or came out at the opposite end of the steel pipe, owing to the paper lining not being securely fixed to the conduit. With the other class I found the paper lining made secure and the surface perfectly hard and smooth and allowing an easy and perfectly free passage for the conductors to be drawn through, which is the correct way for conduit wiring to be carried out.

Again, with regard to Mr. Rawley's earthing device, I hope he has not patented his idea of rasping the ends of an ordinary Simplex conduit in order to make what he considers a good enough joint. I would like him to see the ends of this tubing after being buried in cement or plaster for a few days. I am afraid the sight of them would be an object lesson to him. In some cases I am certain there would be no "ends" to be seen after the taking away of the cement.

The earthing test he writes about must have been a very poor affair. Mr. Rawley may as well suggest jointing conductors together without soldering them; they would not be seen when covered by some charitable insulating tape and the test may also be passed, but it is only a very shoddy job after all.

J. J. Geraghty.

Derby, *May 16th*, 1904

Street Lighting with Nernst Lamps.

Reading the article on Nernst lamps in last week's REVIEW, which I think touches the cable jointer very keenly, viz., "one jointer 8½d., and one labourer 5½d., will do one road crossing and one other lamp in 10½ hours." This is very well as it goes, but does the writer mean that the labourer gets the ground out by himself, while the jointer is disconnecting the old lamp, or wiring the bracket, or does he mean the jointer to have another shovel, thus making two navvies getting out the ground instead of one? Some cable contracting firms are getting apprentices to serve their time, perhaps three years. After serving this time, have they then to go back and learn the art of excavating? If so, I think it rather a poor look out for the jointer. Most labourers in London get 7d. an hour, and surely a jointer can class himself as a mechanic if he is any sort of a jointer at all, to get the extra money. Most Corporations and Borough Councils, if advertising for a jointer, wish for three testimonials to study his pedigree. So if they have to be so careful on their side, I think the jointer has quite enough responsibility on him, as it is, to complete his own work, and not take a labourer's work away for the sake of sweaters.

Live and Let Live.

Mr. Joseph concludes his excellent article in last week's issue by saying that the central station engineer has to ask himself "Can I dump current at ¾d. a unit?"

This seems to us the crux of the whole question, and it also seems to us that the only answer that can at present be given in the majority of cases is an emphatic No!

Mr. Joseph lays it down that, "the cost of current is taken to be the cost of generating extra units during the time that the plant is running."

Very good! but what if, as is quite probable in a small station with units of about 100 KW. capacity each, plant has to be run to generate the aforesaid extra units which would otherwise not be required, for it must not be forgotten that street lamps will, in practically every case, require to be lit when the station load peak is on. Presumably the improved load factor, which the author foretells, and which, in his opinion, will justify "dumping" the units, would grow beautifully less!

Then again, why should there be no charge for labour, repairs, maintenance, &c.?

It seems quite false logic if coal and water, &c., are to be charged for, that labour should be dismissed in so peremptory a fashion.

And why should not the losses in distribution, &c., be proportioned? The author mentions that he has about 12 miles of cable for his street lighting, and surely he does not wish us to believe the improved (?) load factor would allow for all this!!! In our opinion every unit generated in the station for whatever purpose should bear its full proportion of *all* costs, and most certainly when the selling price is under consideration.

Street lighting is, no doubt, a case in which a narrow margin of profit is sufficient, but there should always be that margin; however, Mr. Joseph does not deal with this, as he omits profit from his summary.

There are a few other points which the author has omitted, notably, allowance for cleaning of the globes, &c., which we should imagine he finds necessary, but this is doubtless a mere oversight, though it adds to the cost of maintenance, and should not something be put by for depreciation? Nernst lamps, switches, and even cables have an annoying way of developing faults!

In conclusion, we are afraid that, although street lighting is a load which all station engineers should strive after, the time is not yet that they can afford to "dump" current at ¾d. a unit, which, in the majority of cases, is below even the coal costs, and in nearly every instance below the works costs.

We have noticed, by the way, that in those most admirable tables of costs which week by week help to fill up the columns of a contemporary, that the coal cost, together with oil, waste, and stores at Folkestone, from which generating station, we believe, Hythe is supplied, is 1·21d. per unit.

Undoubtedly the use of Nernst lamps, which Mr. Joseph so ably advocates, will do much to solve the problem of street lighting; but we think the day is not far distant when gas lighting in our streets will be practically unknown, and that without the engineer being under the painful necessity of giving current away, which is practically what Mr. Joseph advises.

Two Shift Engineers.

Automatic Cut-outs.

In the note on "Automatic Protective Devices" in your last issue, you suggest that one of the difficulties we referred to—of cut-outs failing to operate on a very heavy reverse current accompanied by an abnormal drop of pressure—might have been overcome by the use of a plain drum-wound armature instead of a slotted H-shaped armature. This, I may say, was the solution that occurred to us immediately we experienced this difficulty. We were not, however, satisfied with this construction, because it weakened the operating pull to such an extent as to render it unreliable.

There should, of course, be no hesitation about the action of a cut-out. Immediately the armature or core begins to move, the forces tending to move it should increase rapidly, so that it will tend to strike the releasing catch with a smart blow and operate the cut-out with certainty. The H-shaped armature and all the other devices exhibited possess this feature. Immediately the armature commences to move, the reluctance of the magnetic circuit is appreciably reduced, and, as a consequence, the forces acting upon the armature are increased. In the case of a smooth-cored armature, however, this starts from the position of maximum torque, and any movement tends to reduce this torque.

The above may be taken as a fair example of the fact that it is a perfectly simple matter to overcome any individual defect peculiar to a particular type of cut-out. The difficulty is to combine in one piece of apparatus a remedy for all defects. This we have only been able to do with the Manchester dynamo type of release exhibited at the demonstration.

Leonard Andrews.

Manchester, *May 17th*, 1904.

Re Recent L.C.B. Inquiry at Brighton.

In last week's issue there is a report on the above subject. Beyond stating that there was opposition by ratepayers there is nothing in the report to guide one as to what the loan was actually for, further than changing over, nor as to the nature of the opposition. As I was one of those who attended the inquiry, I should therefore esteem it a favour if you will allow me, through your journal, to state why I opposed this loan. Taking the £4,000 for changing over first: This money is being chiefly spent on consumers' premises, for supplying new lamps, fuses, switches, and fittings to replace low voltage fittings, and, in some cases, the re-wiring. Not only this, but there are some motors for working lifts, motor fans, &c., in the area, which, as was stated at the inquiry, the Corporation are taking out and supplying new, and placing the old ones in stock.

My opposition to this loan was, firstly, that the Corporation were doing the work themselves, employing about 20 men, and are therefore in direct competition with the private trader, who is already overburdened with heavy rates and taxes, which, I consider, is grossly unfair and unjust. Secondly, I must strongly claim to assert that, after having supplied the area for 10 or 12 years, this charge of £4,000 ought not to be placed to capital account, but to the revenue account, of the undertaking, as has been done in every other town where change of voltage has taken place, and I wanted to show by statements in my possession what other towns had done, but the Inspector stated it was thrashing a dead horse; but I think he got mixed up, and thought I was opposing the change and *not* the expense of same. I also wanted to discuss the depreciation and reserve fund, but the Inspector would not allow discussion on depreciation.

Brighton is about to change its entire system of supply, and this means that the whole of the plant at North Road will be discarded, and with the exception of the small amount which has been written off in sinking fund, the machinery at North Road is valued to day at the same price it was when installed. What I contend is this: that sufficient ought to have been carried to a depreciation fund

each year (since Southwick was decided on seven years ago) to enable this machinery to be written off, less the amount it would fetch by tender, which, according to a tender accepted by the Glasgow Town Council recently, would be about one-fifth of the cost. Not only have we no depreciation fund, but the ordinary reserve fund is so paltry that it won't bear mentioning. Such towns as Glasgow, Huddersfield, and others, are more honourable in their deficits than Brighton in its so-called profits, as they apparently are trying to work on proper business lines. If it is not asking too much, I should like to hear the views of others of your readers on the cost of changing over.

My opposition to the £6,000 for motors for hiring out was not against the purchasing of motors to increase the day load (although I find some towns—Wolverhampton, for instance—charge this item to revenue), as I have always believed that, if you want a machine to pay, it must be worked to its full capacity, but because it is decided to charge for the whole of the current supplied to these motors at 1d. per unit. I find that the latest report on cost of production for Brighton was 1·72d., so that consumers using the day load only will get their electricity nearly ¾d. per unit less than it costs to produce, and whilst the average price obtained for units sold for lighting is 3¼d., that for motors would never be more than 1d., the department therefore supplying the motor customers with electricity at 2¼d. per unit less than the lighting customers. The argument for this cheap rate is that most of the cost happens at night, when the lighting load is on. But then, if we are to have a day load, we surely are not going to work the same men 24 hours; that would be sweating with a vengeance. Therefore, I think it is very unfair to make the consumer who uses the light pay for the consumer who uses the motor; hence my opposition. Personally, I should like to see the demand indicator abolished, and a flat rate of, say, 3d. for lighting and 1½d. for power substituted.

A. E. Hewitt.

Brighton, *May 16th*, 1904.

Boiler Setting.

In your remarks to-day *re* boiler setting, I think it is only fair to say that Col. Crompton is almost alone in having recognised my endeavours in the direction of smokeless combustion and correct boiler setting. He made public acknowledgement of the same in September, 1902, at the B.A. meeting in Belfast, and he proved the correctness of my contentions by putting the same into practice at Chelmsford; and no one could inspect two side-by-side boilers with the old and the new settings without recognising what has so long been clear to me—that while air above the fire is essential to complete combustion of bituminous fuel, such air must be thoroughly mixed with the fuel gases, and, above all, these must be maintained hot until they have attained a sufficient intensity of combustion.

W. H. Booth.

2, Queen Anne's Gate, S.W.,
May 13th, 1904.

Municipal Appointments.

I have had the privilege of being chosen as one of the "Short list" for several borough electrical engineer appointments, and I wish to protest against the publication of the names and other particulars of such selected candidates. In my opinion such applications are confidential, and publication, except in the case of *the* successful candidate, is a distinct breach of confidence. The result may be very serious friction between a candidate and his present employer, and the knowledge of such a possibility will, doubtless, cause many a suitable candidate to refrain from applying and so prove a distinct disadvantage to the authority advertising.

The writer does not expect that this letter will result in the practice being discarded, but, he asks you, Sir, to consider the question of refusing the use of your columns for such a purpose.

To those who may be answering advertisements of this class he suggests that they endorse their applications "Private and confidential."

Another matter against which I wish most emphatically to protest is the appointment of men at a salary lower than that advertised. Only last week the writer was interviewed, and two of the candidates were asked if they would accept a lower sum; one at last agreed and was duly appointed. This, Sir, I submit, is a most immoral proceeding, happily unfrequent, but several such instances have come to my knowledge. Personally, I should not have accepted a lower salary had I had the option, and when I say that the only item towards the expenses allowed was the railway fare and that, in my case, the journey could not be made in less than two days, it is clear that the unsuccessful candidates were induced to incur expenses and inconvenience without having a chance of being in the running.

Modulus.

[In regard to the suggestion that names of candidates should be withheld from publication, we would say that we are sometimes expressly requested to record the fact that Mr. So-and-So was among the selected candidates. Therefore we have lately made a practice of doing this in all cases unless specially requested to the contrary. We should like to hear other views on the subject.—Eds. E.R.]

Interconnection of Rotary Converters and Transformers.

I should be very deeply indebted to you, or any of your numerous readers, if you could inform me where I could find a complete exposition on the interconnection of static transformers and rotary converters, tracing out the phasal conditions of current and volts, and likewise ratio of conversion for each system of interconnection.

Messrs. Parshall and Hobart in their standard work assume rather too much as apparent on this particular point.

H. Teasdale.

[Name Wanted.—A correspondent wants to know the name and address of the manufacturers of the "Economic" (British made) incandescent electric lamp.]

NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION'S DINNER.

On Wednesday, last week, the first annual dinner of the above Association took place at the Hotel Cecil, Mr. W. Davenport, secretary, in the chair. Amongst those present were representatives of 32 firms, and a considerable number of visitors, whilst the guests included Messrs. W. R. Rawlings, president of the National Electrical Contractors' Association, A. Rashleigh Phipps, and T. McDermott, representing the Joint Committee of the two Associations.

The tables were exceptionally well decorated with flowers, and the menu was equally satisfactory. After the loyal toasts had been duly honoured, Mr. F. H. Nalder proposed "The Imperial Forces" in a very brief speech, coupling with it the name of Lieut. E. J. Hogan. In his reply, Mr. Hogan eulogised the Navy, whose officers are all scientists nowadays, and praised our ever-busy Army for the purity of its administration. The auxiliary forces, to which the speaker belonged, were mainly defensive, and their efficiency depended largely upon the patriotism of employers, for volunteers *must* attend camp, or fall behind in efficiency.

The chairman next proposed "Success to the Association," which he congratulated upon the progress which it had made in a very short period. The Association had been born to meet the growing requirements of a comparatively new industry, and already counted 64 firms amongst its members, whilst it had the substantial balance of £100, which the Committee had invested as the nucleus of a permanent reserve. It had entered into close relations with the National Electrical Contractors' Association, which he hoped would prove mutually beneficial, and a Joint Committee of four members of each Association had been appointed to deal with matters of common interest. Mr. C. S. Northcote, in replying, remarked that a few years ago such an Association would have seemed impossible. Recalling the formation and affiliation to the I.E.E. of the Northern Society of Electrical Engineers, he thought that the N.E.M. Association was more likely to affiliate than to be affiliated, and that it would attain a position of considerable importance.

Before proposing "The Electrical Profession and Industry," Mr. H. Hirst addressed a few "serious words" to the Association. He could not help feeling that this Association was a reflection of another one, which appeared to have exercised some influence over the framing of the rules. The Manufacturers, he thought, ought to regard their relations with the Contractors as a mere section of their work, and he mentioned a number of useful functions to which he considered they should devote their energies. The electrical profession and industry now included almost all other industries in their comprehensive scope. With the toast was coupled the name of Mr. W. M. Madden, editor of the *Electrical Times*. The Chairman briefly replied to Mr. Hirst's criticisms, and Mr. Madden, with equal brevity, replied to the toast, pointing out that as most of the proposer's speech related to the constitution of the Association, and had been answered by the chairman, but little remained for him to do.

Mr. G. Verity then proposed "The Guests and Visitors," remarking that they were proud of the electrical Press, which was not influenced

by unworthy motives, and always played the game. He thought that before launching out into important undertakings, the Association ought to cement the bonds of fraternity between its members, and then, like Mr. Hirst, he pointed out a number of important functions which it might fill, in connection with standardisation, the reform of specifications, and the lock-up of capital—a national question now. Although no member of the Association would admit it, there *had* been slack trade for some time. Whilst he agreed neither with Mr. Byng nor the ELECTRICAL REVIEW, important financial movements were on foot; the Government and others were locking up too much capital, and it was a question whether we were wealthy enough to stand it. In his reply, Mr. Rawlings referred somewhat in detail to the origin of the Association, which he regarded with pride as the offspring of the Contractors' Association. He looked for valuable results from the good relations between the two Associations, and mentioned that the Contractors' Association was taking steps to become incorporated.

Lastly, Mr. David Smith proposed "The Chairman," and paid a cordial tribute to his high qualities, regarding him as a valuable acquisition to the Association. Mr. Northcote and Mr. Nalder at this stage formally presented the chairman with a beautiful silver salver, bearing an inscription and a tea and coffee service, as a mark of the appreciation of his services by the Association. The chairman suitably acknowledged the toast and the presentation, and expressed the pleasure which he felt in being of use to the Association. The formal proceedings closed with "Auld Lang Syne." The speeches were humorous and therefore brief, and were interspersed with a programme of music under the direction of Mr. Alfred Hayes.

OUR LEGAL QUERY COLUMN.

[Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.]

"VENDOR" writes:—"Can a supply authority, 'company or corporation,' working under a provisional order, legally supply electricity at a lower fixed rate per unit, to, say, a theatre, hotel, or public building, than to a private individual. I have good reason to believe that my neighbour has been charged at a lower rate than myself for, say, two years. Have I any legal right to demand repayment of the difference charged, providing I can prove this?"

*** Sec. 19 of the Electric Lighting Act, 1882, provides that where a supply of electricity is provided in any part of an area for private purposes, then, except in so far as is otherwise provided by the terms of the licence, order or special Act authorising such supply, every company or person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply. Sec. 20 provides that "The undertakers shall not, in making any agreements for a supply of electricity, show any undue preference to any local authority, company, or person, but, save as aforesaid, they may make such charges for the supply of electricity as may be agreed upon, not exceeding the limits of price imposed by or in pursuance of the licence, order, or special Act authorising them to supply electricity." It does not follow from this section that the undertakers must supply to all consumers on the same terms. In the case of the Metropolitan Electric Supply Co. *v.* Ginder ((1901), 2 ch. 799), an intending consumer signed a form of request to an electric lighting company, subject to, *inter alia*, the following terms:—(1) The consumer agrees to take the whole of the electric current required for the premises mentioned below from the company for a period of not less than five years; (2) The charge for electric energy to be 4½d. per B.T. unit. No quantity was specified; there was no covenant by the company to supply, nor by the defendant to take, any energy. Similar forms of request had been signed by other purposes for different terms of years, and at different prices. The company afterwards supplied another consumer under contract for two years at 4d. per unit; but he was a large consumer, and took his supply in the daytime, which was an advantage to the company. It was held that this did not amount to undue preference under the above sections, and that the phrase "similar circumstances" in Sec. 19 should be strictly construed. If "Vendor" looks into the matter, he will probably find that there are special circumstances which entitle his neighbour to abatement. If there are no such circumstances an action will lie against the supply.

LEGAL.

SMITH *v.* PARE.

THIS case came before Mr. Justice Lawrance and a special jury last week, and was an action brought by Dr. E. A. Cloete Smith, of 1, Westbourne Street, Hyde Park, to recover £105 for professional services rendered to the wife of the defendant, Mr. W. Luscombe Pare, of 3, Courtland Terrace, Kensington. Plaintiff also claimed damages for assault. The defendant denied that he was indebted to the plaintiff, and said that his treatment of his wife had been negligent and unskilful and useless. Defendant admitted the assault, and brought £2 into Court in respect of it. He counterclaimed damages from plaintiff for negligence in improperly treating Mrs. Pare.

Mr. Duke, K.C., and Mr. Alan Macpherson appeared for the plaintiff; and Mr. M'Call, K.C., Mr. Bateson and Mr. Boddington for the defendant.

Dr. SMITH'S case was that he had for many years paid particular attention to the electric treatment of disease, and from the first had studied Röntgen rays and had constantly employed them. On March 9th, 1893, defendant called upon him with reference to his wife, saying that she had been operated on by Sir Victor Horsley, and that her condition had again become bad. Plaintiff advised that the treatment advisable for her was the high frequency current combined with the X-rays. Defendant the next day telegraphed that after consulting Horsley and Huxley, he had decided to use the plaintiff's treatment. It was then arranged that plaintiff should go to St. Leonards and apply to Mrs. Pare the X-ray treatment and the high frequency current. He went to St. Leonards, examined Mrs. Pare, and arranged the apparatus and gave instructions to Mr. Chaplin, an electrician, of St. Leonards, to give the patient two hours of the high frequency current twice a day if she could bear it, and the X-rays at a distance of 16 in. to 20 in. from the body, and to use his own judgement as to the length of the exposure. Plaintiff visited Mrs. Pare from time to time, and finding that her condition had improved slightly, he directed that the high frequency current should be discontinued. Mrs. Pare afterwards came to London, and there the X-ray treatment was continued by the nurse under the plaintiff's instructions. Plaintiff attended the lady constantly during April, and saw the first symptom of dermatitis about a fortnight before he was dismissed from the case. He took measures to protect the skin by the use of tinfoil. He said that dermatitis was a probable incident of the X-ray treatment, which was the only treatment which could benefit the patient. Defendant had not paid his account, amounting to 100 guineas. On June 9th, when paying a visit to the hospital, defendant came up to him and demanded to know what ought to be done to his wife. He then assaulted plaintiff with his umbrella, and first bit his hand, and seriously injured his hand and eye.

PLAINTIFF was cross-examined by Mr. M'Call, K.C. He stated that Mr. Pare consented to the X-ray treatment, and did not ask if it would cause pain and burning. He believed that Sir Victor Horsley had consented to the X-ray treatment of Mrs. Pare. The treatment had no direct effect on the internal cancer, but it improved the patient's general condition. He told Mrs. Pare that X-rays would give her relief from pain. He did not tell her that one of the probable consequences of the treatment was dermatitis, and the pain that followed it. He was informed by the nurse that she had lost weight, but did not know that she had lost 6 lbs. in eight days. Her condition was so serious that the nurse stopped the treatment altogether. He agreed that the loss of weight was a very serious matter, but he directed the treatment to be resumed, because it had been found to be generally beneficial and to increase weight in cases of cancer. Towards the end of April Mrs. Pare's weight had been reduced to 4 st. 8½ lbs. The X-ray burn was the most intractable form of burn to deal with, but what Mrs. Pare was suffering from was dermatitis.

Was there destruction of the skin?—Yes.

His LORDSHIP: Blistering?—Yes.

Mr. M'CALL: Was the effect of your treatment that she had lost a stone in weight, had her skin burned, and suffered intense pain, while the disease was just as it was before?—To the last question, no; to the others, yes.

Do you know that from that day to this the unfortunate lady has been unable to straighten herself, owing to the state of her skin?—This burning was not the usual result of his treatment, but he did not say it was due to carelessness. Mrs. Pare had been properly and scientifically treated.

Dr. A. H. GREGG, superintendent of the X-rays Department of St. Thomas's Hospital, said he examined Mrs. Pare last month, and found her suffering from dermatitis; but there was no evidence of the continued presence of cancer, and her general health was fair. If her condition before the treatment was as had been stated, the cure was a very remarkable one. Cross-examined, Dr. Gregg said that the X-rays had been proved to have a beneficial effect on the external symptoms of cancer, and he was aware of a few cases where they had mitigated the pain of internal cancer, but he had never known of a case of cancer being cured by them.

Mr. A. CHAPLIN, medical electrician, who, under the direction of the plaintiff, applied the X-ray treatment to Mrs. Pare while at St. Leonards, stated that, as the high frequency treatment seemed to increase the pain, he discontinued it after five days, with the consent of the plaintiff. On five occasions he gave treatment for a full hour.

The plaintiff's case was closed.

Mr. M'CALL, in opening the defendant's case, said that Mr. Pare had fought this case because he was convinced that investigation in a public Court was necessary in the interests of his family and of those who were liable to such treatment as the plaintiff had imposed on Mrs. Pare.

On Wednesday, May 11th, Nurse TRINDER was examined as to the extent of the "burning" of Mrs. Pare by the X-rays. In cross-examination she said she did not understand anything whatever about the Cloete Smith treatment, and disapproved of it from first to last. In March, when the treatment commenced, she regarded her patient as a doomed woman, but by the middle of June Mrs. Pare's condition showed a general improvement. In December, when witness left, Mrs. Pare was undoubtedly better. She had complained to Mr. Pare about his wife being "tortured," and he replied that the treatment must continue because his wife's relations insisted on it.

Dr. HENRY HUXLEY denied that he consented to the X-ray treatment. He raised no objection to the "high frequency" treatment, because he knew it could do no harm, although it would have no good effect on cancer. There was no evidence yet of the X-rays

being any good for deep-seated cancer. Cross-examined: The X-ray treatment might destroy external cancer. Mrs. Pare had no symptoms of cancer now, and had none previous to the treatment.

Sir Victor Horsley said that Mrs. Pare had a growth of a suspicious nature, but it certainly was not cancer. He had not consented to the X-ray treatment; and although he was of opinion that the "high frequency" currents would do no harm, he did not think they would do much good, especially in view of the character of the circular. Cross-examined: Mrs. Pare was desperately ill in March last year, and it was doubtful then whether it was tubercle or a malignant growth in the lung. He had used the X-rays for superficial cancer of the skin, but with regard to internal cancer, his experience was that the rays could neither mitigate pain nor alter the course of the malady. Mrs Pare's general health had greatly improved, but the lung trouble was incurable. Re-examined: He had never in his whole life seen such a case of burning. He thought it was a unique case of damage done.

Mr. Pare said he was an advertising agent, and knew nothing about medical or electrical science. His wife had been suffering from tubercular disease of the lung, and was in an extremely critical condition. He was persuaded by the ladies of his family to call upon Dr. Cloete Smith. Personally, he was strongly adverse to the adoption of the treatment. Dr. Cloete Smith repeatedly assured him that the treatment was painless. He was not asked to consent to any X-ray treatment.

On 12th inst. Mr. Pare, cross-examined by Mr. Duke, said he was distinctly assured by Dr. Cloete-Smith that the treatment was painless. He could not say when he first became aware that a gross deceit had been practised upon him. He was under the impression that the high-frequency treatment was being applied. He had known of the injury to his wife six weeks before he assaulted Dr. Cloete Smith, but had not seen it. He was unable to say why he had not communicated with the plaintiff during that period.

The jury found that the defendant did not consent to the X-ray treatment, and that the treatment was improper, negligent and unskilful. For the assault they awarded the plaintiff 40s., and on the counterclaim awarded the defendant £100.

As the defendant had paid in 40s. in respect of the assault, judgement was entered for him both on the claim and counterclaim with costs.

Manchester Carriage and Tramway Co., Ltd., and Swinton and Pendlebury Urban District Council.

This was a special case stated on May 28th, 1903, by Sir Frederick Bramwell, as to whether the District Council was to purchase any of the company's depôts outside the district of the Council, and it came before Mr. Justice Channell in the King's Bench Division on Friday last. The late Sir Frederick Bramwell acted as the arbitrator, and the questions arose under Sec. 43 of the Tramways Act, 1870. The appeal was upon the question as to whether the words "within such district" qualified the word "undertaking" so that a depôt situated outside the Council's district, but suitable to and used for the purposes of such part of the undertaking as was within the district, was to be paid for by the Council as part of their undertaking. It appeared that there were two depôts, both outside the Council's district. The special case found that the Church Street depôt was suitable, and used with the Council's undertaking, but that the other depôt was not.

Mr. Fletcher Moulton, K.C., Mr. Eldridge and Mr. E. T. Sanders were for the claimants; and Mr. Balfour Browne, K.C., and Mr. Rhodes for the respondents.

After hearing arguments, his Lordship gave judgement, and said that if the arbitrator had been still alive he would have sent the case back to him; but in his opinion there was some evidence upon which the arbitrator could find that the depôt was suitable. Therefore, in the circumstances, he upheld the special case. Leave to appeal was given.

The South Lancashire Electric Traction Co.

An action, brought by A. G. Grenfell and others against Sir. J. A. Willox, Hon. A. Stanley, Mr. E. K. Muspratt, Mr. J. B. and J. Atherton of the above company, occupied the Nisi Prius Court of the Liverpool Assizes (Mr. Justice Jelf and a special jury) on several days last week. The plaintiffs, in their claim, stated that they were induced to subscribe for certain debentures in the South Lancashire Electric Traction and Power Co. upon the faith of the prospectus issued by the defendants, which contained a statement which was untrue to the knowledge of the defendants, or was in fact untrue. The plaintiffs further alleged that they suffered considerable loss by subscribing for these debentures, and they claimed that the amount of such loss should be made good by the defendants. The defendants, by their defence, said, in the first place, they did not issue the prospectus to the plaintiffs; further, that the statement in the prospectus was not untrue but true; that, if untrue, it was not untrue to their knowledge, and, so far from being untrue to their knowledge, they had reasonable ground for believing that it was true, and said that, in fact, it was true at the time of the issue of the prospectus and up to the date that the debentures were allotted to the plaintiffs.

Mr. Sutton, in opening the case, explained that he made no allegation that implied moral deceit on the part of the defendants. He did, however, allege that the gentlemen who issued the prospectus made a statement that was not true in fact, and plaintiffs would ask the jury to say that they had no reasonable grounds for believing that it was true. If gentlemen of the high standing of the defendants became promoters and directors of companies, they brought themselves under statutory obligations that must be fulfilled, or else they must be answerable in damages to persons misled if they stated that which the Act said they had no right to state. In 1900 Jacob James Atherton introduced into Parliament a Bill to obtain powers to make tramways, and it was backed by Sir John Willox. It did not give power to supply electricity for any purposes other than tramways, and they had not such powers. Afterwards the South Lancashire Electric Supply Co., Ltd., was formed, and eventually it was claimed that power had been obtained for giving a supply of electrical energy for all purposes. Afterwards a new company was formed, the prospectus of which bore the names of defendants, who subsequently became directors. This company was formed to acquire the beneficial interest in, and to develop, as part of a system, the concessions and rights owned or to be obtained by the South Lancashire Tramways Co., Ltd., and the Lancashire Light Railways Co., Ltd. It was called the South Lancashire Electric Traction and Power Co., and it was claimed that they had power to supply electricity for all purposes; whereas, suggested Mr. Sutton, all they could properly have said at the time was that Mr. Balfour Browne had given his opinion that they had power.

The first witness was Mr. Grenfell, who, in the course of his evidence, said he had subscribed in all £4,370, of which he received 10 per cent. back from the Extension Co. The other plaintiffs were also called, and subsequently Sir Edward Clarke, K.C., opened defendants' case, and asked the jury to say that they had a sound and honest belief in the truth of the statements in the prospectus. After defendants had given evidence, the jury intimated that they did not wish to hear a second address from Sir Edward Clarke or Mr. Rufus Isaacs, but wished to hear Mr. Sutton reply for plaintiffs.

Mr. Sutton said that the plaintiffs were entitled to a verdict unless the defendants satisfied them that they had reasonable grounds for believing, and, in fact, did believe upon the day the debentures were issued, that the statement in the prospectus was true. That must not be a slipshod belief, but it must be a sound and honest belief, founded after giving the matter all the care and attention they could, and after bringing to bear upon the consideration of the question all the information possible. Did the jury think that Sir John Willox, the Hon. Arthur Stanley, and Mr. Muspratt had exercised all reasonable care, which men in their position ought to have exercised? He submitted not. With regard to Messrs. Athertons, he argued that they could not say that they had formed a sound opinion on the question of whether Section 85 of the Act of Parliament gave the company the power to supply electricity in bulk.

His Lordship summed up in a speech occupying about an hour, and the jury retired. His Lordship had put to the jury the questions—(1) Had the defendants, or some and which of them, reasonable grounds for believing, and did they believe, that the statement in the prospectus was true? If, said the judge, the jury found in favour of the defendants on that point, there was an end of the case; but, if not, he asked them (2) were the plaintiffs, or some and which of them, induced to take the debentures by the said statement? And (3) did the plaintiffs, or some and which of them, suffer damage by taking the debentures, and if so, to what extent?

After about an hour's absence (says the detailed report in the *Liverpool Mercury*, to which we are indebted for the above extract of the case) the jury returned, and said that they could not agree.

His Lordship said he could not allow the case to be so quickly disposed of in that way, and he wished to utter a solemn word of warning. He trusted that every single one of them in coming to a conclusion in that case, would be guided wholly and absolutely by what had taken place in that court and in that case; and if they allowed themselves to be influenced by anything which had taken place in any other case, or with regard to any other individual not in that case, it would be very, very wrong, and contrary to their oaths.

After a further half-hour's absence, the jury returned, and the foreman said they were of opinion that the defendants took reasonable precautions to ascertain that the statements in the prospectus were true.

His Lordship: That is substantially an answer to my first question?

The Foreman: It is, my lord.

During the absence of the jury Counsel had been discussing the interpretation to be placed on the Act of Parliament; but on hearing the verdict of the jury, Mr. Sutton said he would not argue the point of law further.

On the application of Sir Edward Clarke and Mr. Isaacs, his Lordship entered judgement for the defendants with costs.

Londonderry Corporation *v.* National Telephone Co.

In the Chancery Division at Dublin last week, the Master of the Rolls resumed the hearing of this action in which the plaintiffs sought a mandatory injunction requiring the Telephone Co. to remove their telephone poles, wires, and other apparatus from the streets of Londonderry, on the ground that the same had been erected under an agreement entered into between the parties in 1883, under which the company agreed to remove them on six months' notice. The Corporation had given the notice. But the company relied on a new agreement of 1897, whereby they alleged that the former agreement was rescinded, and that the Corporation agreed to the company exercising the powers conferred on them as licensees of the Postmaster-General under the Telegraph and Telephone Act of 1892. The defendants, after the issue of the writ, tendered a consent to the plaintiffs that judgement should be marked against them, with a six months' stay. This the Corporation refused.

The Master of the Rolls (according to the *Belfast News Letter*) held that the agreement of 1883 had not been rescinded, and being

still in operation the Corporation had power to determine on six months' notice, but he considered they had acted rather harshly towards the company. He granted the injunction without costs, and put a stay in it for six months.

ELECTRO-PLATING APPARATUS CO. *v* MORRISON.

IN the King's Bench Division on 12th inst. Mr. Justice Darling had this case before him. It was a motion by defendant to set aside a judgement. From a report in the *Warrington Observer* we gather that plaintiffs were proprietors of certain apparatus for electro-plating and burnishing in one operation, and the defendant had a similar patent of a later date. He had made arrangements to work the patent in Walsall with the plaintiffs, and they on one occasion handed him a piece of paper, which he had since learnt was a writ for an infringement of their patent. In February, 1903, he received a letter stating that an order had been made against him by Mr. Justice Darling restraining him from infringing plaintiffs' patent. He now said he had a good defence to the action, but wished to plead as a pauper.

In answer to the JUDGE, Mr. COLFAX admitted that the question of infringement had not been tried, but in many cases of prosecution for infringement the defendants did not appear, and judgement went by default, as in this case. His clients did not wish to cause Mr. Morrison any loss, and would undertake to grant him a personal license for himself and family to work the patent, but he must not seek to assign it to anyone else. The record could be withdrawn and the proceedings stayed, so that the plaintiffs would be in the position of never having started an action. So long as the patent was kept to the defendant's family, no action would be taken, but if he attempted to assign it, proceedings would be taken.

The JUDGE said he thought one of the offers made by the plaintiffs ought to be taken. He should not make the order asked for by defendant, and would adjourn the case to allow of a settlement.

ELECTRIC TRAMWAYS CONSTRUCTION AND MAINTENANCE CO., LTD.

THE petition of Mr. A. J. Paine for the winding-up of this company was before Mr. Justice Buckley on Tuesday, as well as two summonses relating to the same company.

Mr. WILKINSON, for the petitioner, a contributory, said that the petition had been ordered to stand over from January 26th until the summonses were disposed of, one taken out by the company, and the other by the petitioner, the former asking that all proceedings should be stayed pending the trial of an action for rectification of the register by striking out the petitioner's name. The late Mr. Justice Bryne had made an order on each summons that it should stand over for 14 days until the action by the company had been disposed of. There had been some little delay in setting the case down, and petitioner took out a notice of motion to dismiss the action for want of prosecution. The case was a little complicated by reason of the Public Prosecutor having taken the matter up.

His LORDSHIP: Proceedings elsewhere?

Mr. WILKINSON: Yes, at Bow Street.

In the result his Lordship saw Mr Justice Kekwich, before whom the action would come. Mr. Justice Kekwich stated that he could not take the action before the middle of July, and Mr. Justice Buckley directed the petition and summonses to stand over to July 12th.

NATIONAL ELECTRIC TRACTION CO, LTD.

THIS matter came before Mr. Justice Buckley in the Companies Winding-up Court on Tuesday.

Mr. CANNOT said that Mr. Octavius Hunt, who was substituted for the petitioners last week, had been settled with. The petitioners had been settled with last week.

His Lordship accordingly dismissed the petition.

MACARTNEY, MCELROY & CO., LTD. *v.* BRIGHTON CORPORATION.

THIS case again came before Mr. Justice Grantham in the King's Bench Division on Monday, it having been arranged that points of law should be argued. The action, which was recently tried before his Lordship and a special jury, was brought to recover from the defendant Corporation the sum of £16,000 for work done in connection with the laying of the first lines of electric tramways in Brighton. The jury returned a verdict by which they awarded the plaintiffs £14,621 7s. 6d., and it was then agreed that the legal aspect of the case should be argued at a later date.

Mr. Montague Lush, K.C., and Mr. Cautley appeared for the plaintiffs, and Mr. Fletcher Moulton, K.C., Mr. W. P. G. Boxall, K.C., and Mr. C. C. Scott represented the defendants.

Mr. MOULTON submitted that there was no ground for the variation of the contract. The work which had to be done came under Sec. 174 of the Public Health Act of 1875, which provided that every contract exceeding £50 in value entered into by an urban authority must be in writing and sealed by the Common Seal of the authority. This swept away the idea of an agreement between Mr. May, the borough engineer, and the plaintiffs, and contended that any such agreement could have no effect at all. Consequently the contention of his learned friend that there could be any rectification of the contract was quite impossible. Sec. 174 was an obligatory provision for such contracts as this one; therefore, either plaintiffs must produce a contract under seal, or they were non-suited. He also submitted that the plaintiffs unquestionably knew the point as to what the specification and contract meant. No agreement as to the interpretation of the contract could alter the contract. Counsel then proceeded to argue that the excavating, concreting, and floating under the wood-paving, formed part of the contract works, and that the sum to be paid, included all such work. If it was necessary that such work had to be done, the plaintiffs could not recover. The word "works" which was mentioned in the contract, clearly meant all the things which were necessary for the carrying out of the contract in a satisfactory manner. A sum of 12s. 7d. per yard had been agreed upon in connection with the wood paving, and they could not get away from this amount.

Mr. LUSH, replying, said his first point was as to what the contract meant as it was drawn; the second point was, if it was wrong, the plaintiffs were entitled to have the contract put right; and his third point was that, inasmuch as the Corporation had paid £9,000 for the work, they could not get the money back. Clause 103 laid down that the amount given in the schedule of quantities would be added to or deducted from the lump sum item. In spite of this, however, the defendants would deduct 18s. for what plaintiffs did not do, although they only paid 12s. 7d. for what plaintiffs did do. He submitted that the deductions should correspond with the payments. There was not one syllable in the contract which suggested that the plaintiffs' price included the making of the concrete bed.

After hearing Mr. Boxall, K.C., his Lordship reserved judgement.

PARLIAMENTARY.

ROYAL COMMISSION ON LONDON TRAFFIC.

AT the sitting of this Commission on Thursday last week, evidence was given by the chief engineer to the South Metropolitan Gas Co., Mr. CHARLES CARPENTER, who spoke in favour of gas for street lighting, comparing its illumination with "the patchy effect given by high-power electric arcs." Incandescent gas lamps were also much cheaper. An endeavour had recently been made by a South London borough council who owned an electric light undertaking to place standards in the middle of the roadway, but with unfortunate results. Witness was examined at some length on the question of road opening.

Mr. C. A. BRERETON, M.I.C.E., practising in partnership with Sir John Wolfe Barry, said that he had had considerable experience in connection with providing accommodation for traffic in and around London and elsewhere. Having detailed the various railway schemes with which he had been connected as engineer, he passed on to a consideration of the London traffic problem. In his opinion, the best way of dealing with the ever-growing congestion of traffic would be the construction of a broad road running through London from east to west. The road should have provision for a railway and tramway underneath. Another broad road should also be constructed from north to south. (Witness submitted maps.) The east and west route was the more important of the two. It would commence at the junction of Kensington Gardens Terrace and the Bayswater Road, and, running a little north of due east down Connaught and Upper Berkeley Streets, would pass through Portman and Manchester Squares, across Portland Place and Tottenham Court Road, into Russell Square. From there the street would proceed to Guildford Street, where it would turn due east as far as Goswell Road; at Goswell Road it would deviate in a south-easterly direction, and, just touching the north side of Finsbury Circus, would pass in front of Liverpool Street Station. The road would eventually end in a circus situated at the junction of the Whitechapel High Street and Commercial Road. The road would provide a through route by means of existing roads from Ealing, Acton, Hammersmith and Shepherd's Bush to Whitechapel, Limehouse and the Docks. In laying out the route, he had endeavoured as far as possible to widen existing roads on one side only, and thus avoid interference with buildings of public importance and interest. The section of the main road from east to west should be a double-storeyed one, providing for a surface road 140 ft. wide between the building line, with 18-ft. pavements, under which cellars of the houses could be constructed. Under the roadway would be two lines of electric trams, a double line of electric railway, and the sewers. A continuous footway would be constructed on each side of the tramlines, with accesses at intervals from the street, which, besides serving the tramways, would afford underground crossings for foot passengers at important junctions with wide streets. The railway would be worked by electricity, and could be connected with the main lines at the east and west ends, and relieve the streets of heavy carting traffic, besides providing for through passenger traffic. The north to south road would commence at the junction of St. George's, New Kent, and London Roads, and run nearly due north, crossing the river by a new bridge to the west of Blackfriars Bridge. It would then proceed down the Gray's Inn Road and the Caledonian Road to the terminus at the junction of the Seven Sisters and Holloway Roads. Coming to a consideration of the cost of the roads, witness said that so far as it had been possible to arrive at an estimate, the total cost of the west to east route would be about £6,125,000 for the whole length of about 5 miles. The 4½ miles of the south to north route might be taken to cost about £2,550,000.

By Sir JOHN WOLFE BARRY: In the cost of the streets was included the cellars and the cost of the subways for gas and water pipes. The width of Parliament Street opposite the new public offices was 142 ft. The Embankment was 110 ft. wide. The estimate of the north and south route included the cost of the bridge

over the Thames. In both cases the figures excluded the cost of land.

Mr. A. R. Stenning (Messrs. A. R. and F. Stenning, surveyors) was then called. He said that he was one of the surveyors for the proposed tube railway from Hammersmith to Tottenham, and gave evidence before the Joint Commission. He was also surveyor for the Hammersmith and City Railway, and many other tube lines. He was a surveyor to the Great Central Railway, and assisted in the selection of the site of the terminal station of that railway at Marylebone. He was connected with many schemes of communication, including the Tower Bridge. No doubt the greatest traffic in London was from east to west parallel with the river. The new road suggested by Mr. Brereton would greatly relieve the traffic, and could be constructed without great disturbance of property except in the City. He had estimated the cost of the properties that would be required for such widenings of existing streets as were necessary at £11,293,550, on which there would be a possible recoupment of £2,000,000. The north and south route would necessitate the acquisition of properties estimated by him at £7,000,000, which would possibly have a recoupment of £1,000,000.

Sir J. Whittaker Ellis was the next witness. He said that no doubt the most agreeable method of locomotion was by surface roadway, and that was to be preferred to subterranean passages. Of course, in some cases subterranean routes would be more direct. He was opposed to "the absorption of our thoroughfares either by private speculators, such as Mr. Robinson, or municipal undertakings at the cost of the ratepayers." Wherever a tramway ran it caused great inconvenience to ordinary vehicular traffic.

On Friday, evidence was given by Mr. Harper, the statistical officer to the London County Council. Dealing with the question of London tramways, Witness said that statistics with regard to them were available in a much more complete form than those for railways or omnibuses. A return of tramways had been published annually by the Board of Trade since 1878, and from that return it was possible to obtain much statistical information as to the progress of tramway locomotion in London. The total length of line open for traffic, which was 62·16 miles in 1879, rose to 126·87 miles in 1889. It then remained practically stationary until 1901, and had during the last two years been somewhat increased by the extension of the London United Tramways system. The mileage run by the cars increased from 9,722,678 in 1881, to 34,771,382 in 1903, while the passengers in the same period increased from 71,509,859 to 336,800,596. The number of passengers per car-mile increased from 7·35 in 1881, to 10·46 in 1901, and fell to 9·69 in 1903. The receipts from passengers increased from £531,940 in 1881, to £1,519,046 in 1903, the average fare per passenger in the same period falling from 1·78d. to 1·08d. With a small exception, in the case of the London United Tramway system, the whole of the figures related to horse traction. Witness then went on to deal with the electrification of the L.C.C. lines. In 1902 the number of passengers per car-mile on the lines worked by the Council was 11·56, the fall in 1903 being, no doubt, due to the dislocation produced by the electrification of the tramways. That average of 11·56 in 1902 was 20 per cent. more than that of the lines leased by the Council. In the County of London itself there were now 116·51 miles of tramway open for traffic, of which 89·85 miles were double lines, and 26·46 single lines. The present position of those tramways as to ownership was as follows: Worked by the Council, 39·81 miles; leased by the Council, 48·53 miles: tramway companies, 27·97 miles. On the average there was almost exactly one mile of tramway to every sq. mile of the area of London. Witness concluded by dealing with the questions of fares and workmen's trains and railways.

Colonel R. E. B. Crompton, C.B., Chairman of the Kensington and Knightsbridge Electric Lighting Co., Ltd., was then called. He said that he wished to give evidence on behalf of his company, which represented very important West-end interests. He agreed in the main with the evidence given by Dr. Kennedy. He could not understand the Mayor of Westminster's objection to companies working on the road. He thought that Dr. Kennedy's proposals with regard to reciprocal notice obligations were excellent. His company was the first, in 1886, to break up the streets of London to lay underground mains. He was then engineer-in-chief. They decided that the electric mains must be placed so as to be very accessible, so that costly breaking up should be avoided. The principle of constructing small subways underneath the footways close to the kerb was introduced, and had since been extended wherever possible. With regard to Dr. Kennedy's suggestion that the rule, enforced in some towns, that no cellars should come nearer to the surface of the pavement than 2 ft., should be enforced in London, Witness said that he would go further than that, and say that in the laying out of new streets, or in the widening, &c., of existing streets, a clear space 4 ft. wide, and not less than 2 ft. in height should be left next to the kerb for the construction of such shallow subways.

The Commission adjourned until Thursday, June 2nd, when the final sitting will be held.

L.C.C. Tramways Bill.

(*Continued from page 775.*)

On May 9th, 10th, 11th and 12th the Committee further considered the various tramways proposed under this Bill. The Committee found the preamble proved so far as Tramways Nos. 4 and 10 were concerned.

Tramways Nos. 11, 12 and 13 were considered, and the Committee declared the preamble of the Bill proved in all three sections. Tramways Nos. 15 and 16 were then considered. Having heard a number of witnesses, the Committee sanctioned both lines.

Tramway No. 5 was then described by Mr. Pollock. It was, he said, a double line, a little more than 2¼ miles in length. Its object was the connection of the north and south systems of tramways by means of a line through the Blackwall Tunnel. Commencing in the Trafalgar Road, Greenwich, by a junction with the existing tramway, it would terminate in the East India Dock Road by a junction with the Commercial Road tramway, which, added counsel, would be the first portion of the northern system to be worked electrically. The total cost of the line would be £75,710. The proposal had the approval of the local authorities on both sides of the river, and was opposed by only a few frontagers. The police, however, had certain objections to the passage of the tramway through the Tunnel. Having heard evidence, the Committee deliberated, and, as a result, decided not to sanction the tramway through the tunnel or down the approaches.

The remainder of the line from Trafalgar Road was approved.

Electric Lighting Provisional Order (No. 6) Bill.

The Electric Lighting Provisional Order (No. 6) Bill came before the Examiner of Standing Orders on Friday, and was ordered to go to the House for second reading. The Bill confirms Board of Trade Orders in respect of the following districts:—Order granted to the Western Electric Distributing Corporation, Ltd., whose registered offices are 38, Parliament Street, Westminster, in respect of the Urban Districts of Clevedon and Portishead, and the Rural District of Long Ashton, in the County of Somerset; order granted to Messrs. Christy Bros. & Middleton, of Chelmsford, Essex, in respect of the Urban District of Crediton, in the County of Devon; order granted to the Corporation of Devizes, in respect of Devizes; order to the Twickenham and Teddington Electric Supply Co., Ltd., in respect of the Urban Districts of Hampton Wick, Esher, Dittons, East and West Molesey, and Sunbury, and the parishes of Hanworth, Feltham, Ashford, and Shepperton; order granted to Mr. Harry James Almond, of 18, St. Helen's Place, London, E.C., in respect of the Urban Districts of Houghton-le-Spring, and Hetton-le-Hole, and the Rural District of Essington, in the County of Durham; order granted to the Urban District Council, in respect of the Maldens and Coombe, in the County of Surrey; order granted to the Northampton Electric Light and Power Co., enabling them to extend their area of supply to Moulton, Boughton, Brampton, Hardingstone, Wootton, Great and Little Houghton, &c.; order granted to the Gloucester Electric Power Co., in respect of the Rural District of Stroud, the Urban District of Nailsworth, and the Parish of Dursley; order granted to the Western Electric Distributing Co., Ltd., in respect of the Urban Districts of Trowbridge and Bradford-on-Avon, and the Rural District of Bradford-on-Avon.

Tramways Orders Confirmation (No. 2) Bill.

On Tuesday the Examiner of Standing Orders in the House of Lords found that the necessary conditions had been complied with in regard to the above Bill confirming orders granted by the Board of Trade under the Tramways Act to the following:—Order authorising the United Kingdom Tramway, Light Railway, and Electrical Syndicate, Ltd., to construct tramways in the urban districts of Bishop Auckland, Sheldon, East Thickley, and the rural districts of Auckland and Durham, in the county of Durham: altogether between 16 and 17 miles of lines are scheduled; order authorising the Corporation of Dewsbury to construct three small lengths of tramway in extension of existing system; order authorising the Urban District Council of East Ham to construct certain tramways in their district authorised by the East Ham Urban District Council Tramways Order of 1900; order authorising the Ossett Corporation to construct about a mile of tramway in the borough; order authorising the Corporation of Sunderland to construct an additional tramway; order authorising the Corporation of West Ham to construct a small junction line.

St. Marylebone Electric Lighting Bill.

A Select Committee of the House of Lords, presided over by Lord Brougham and Vaux, had this Bill before them on Friday last week. The promoters (the Borough Council) were represented by the Hon. J. D. Fitzgerald, K.C., Mr. Honoratus Lloyd, K.C., and Mr. Vesey Knox.

The Hon. J. D. Fitzgerald, in opening the case for the promoters, entered at some length into a history of the electric lighting in Marylebone from the time of the old vestry. The Bill had already passed a Select Committee of the Lower House, who had imposed certain conditions with regard to the sinking fund and the period of loan. The object of the Bill was to obtain power to enable the Council to raise the necessary money, £1,500,000, for the purchase of that portion of the undertaking of the Metropolitan Electric Supply Co. which was situated in the Borough of Marylebone. The Bill was opposed by the Gas Light and Coke Co., and counsel contended that the company had no *locus*. The Committee, however, decided to hear counsel for the gas company.

On Monday last it was announced that an agreement had been come to between the local authority and the gas company to the following effect, that Clause 34 should be altered to read:—"There shall not be charged against the general rate in respect of street lighting or other municipal purposes for which such energy shall be employed, any larger amount than is charged to ordinary consumers using energy during like hours of supply."

The Committee then found the preamble proved, and the further clauses were adjusted.

Petitions.—The Southampton Gas Light & Coke Co. have given notice of their intention to oppose the Eastleigh and Bishopstoke Order in No. 2 Provisional Order Bill, and the Longwood Gas Co. will oppose the Huddersfield Order in No. 3 Provisional Order Bill. Notice of opposition to the Harrow Road and Paddington Tramways Bill has been given by the Willesden U.D.C. The following petitions against private Bills have been presented: By the Lanark County Council, against the Clyde Valley Electrical Power Bill; by the Great Western Railway Co., the L. and N.W. Railway Co., and the Fulham Borough Council, against the Metropolitan District Railway Bill.

Weights and Measures (Metric System) Bill.—In the House of Lords on 16th inst. on the report stage of this Bill, Lord Belhaven and Stenton proposed some amendments to Clause 3 (future deeds, contracts, &c., to be in terms of metric system of weight), which, he said, had been drawn up by the Home Office and the Board of Trade. The principal amendment provided that any person who made a contract, bargain, &c., contrary to the provisions of the section should, on conviction, be liable to a fine not exceeding 40s. The *Times* reports that the amendments were agreed to.

BUSINESS NOTES.

Electrical Wares Exported.

WEEK ENDING MAY 19TH, 1903.

Adelaide	£50
Alexandria	21
Amsterdam	183
Arica. Teleg. mat.	29
Auckland	15
Bangkok. Teleg. mat.	77
Bluff	77
Bombay	171
Buenos Ayres	203
Calcutta	397
Cape Town	46
,, Teleg. mat.	125
Channel Islands. Teleg. poles	86
Constantinople	70
Delagoa Bay	1,117
Durban	709
East London	638
Flushing	21
Gibraltar	100
Kobe	118
Libau	270
Madras. Teleg. mat.	201
Monte Video	49
Penang	200
Perth	481
Port Elizabeth	894
,, Teleg. mat.	1,309
Rotterdam. Teleg. wire	12
St. Petersburg. Teleg. cable	66
Sekundi. Teleg. mat.	20
Singapore	267
Sydney	83
Wellington	1,580
Total	£9,135

WEEK ENDING MAY 17TH, 1904.

Aden. Teleg. mat.	£72
Alexandria	325
Amsterdam	192
Auckland. Teleg. mat.	272
Bangkok	298
Bombay	98
,, Telephone	182
Buenos Ayres	347
,, Teleg. cable	112
Calcutta	1,421
,, Teleg. cable	155
Cape Town	395
Colombo	40
Constantinople	54
Delagoa Bay	336
Demerara	11
Dunkirk	9
Durban	1,148
,, Teleg. cable	43,000
East London	437
Fremantle	84
Gibraltar	2,664
Gothenburg	95
Le Treport	46
Lisbon. Elec. instruments	21
Melbourne. Elec. machinery	490
Ostend	21
Otago. Teleg. mat.	18
Paris	48
Penang	28
Perth	288
Port Elizabeth	1,575
Quebec	54
Rio Janeiro	12
St. Petersburg	671
,, Teleg. cable	820
Saigon	9
Santos	23
Shanghai	566
,, Teleg. cable	28,600
Singapore	56
Sydney	194
,, Teleg. mat.	87
Tokio	402
Wellington	358
,, Teleph. cable	985
Yokohama	95
Total	£87,049

Foreign Goods Transhipped.

Melbourne. Telephones	£350

Antwerp. Elec. goods	£15
Auckland. Elec. mat.	15
Boulogne. Elec. goods	22
Durban. Elec. goods	208
Gothenburg. Elec. goods	13
Shanghai. Elec. goods	175
Singapore. Elec. apparatus	23
Total	£471

National Electrical Contractors' Association (Northern Section).—On Friday, May 13th, the Leeds Branch of the Northern Section N.E.C.A. gave a dinner at the Hotel Metropole, Leeds. Mr. E. C. Wallis presided, and was supported by Mr. P. N. Hirst, chairman-elect of the Leeds branch, and representatives from Leeds, Bradford, Huddersfield, Sheffield, Nuneaton, Newcastle, Liverpool and London. Music was rendered by a small orchestra of ladies during dinner, after which the usual toasts were duly honoured, interspersed with speeches, songs and instrumental music. Among the guests present were Mr. W. R. Rawlings, president N.E.C.A.; Mr. E. L. Berry, president London N.E.C.A.; Mr. R. Tweedy-Smith, hon. solicitor; Mr. Wilson Hartnell, of Leeds; and Mr. J. B. Norton, of Sheffield; all of whom, with several others, spoke on subjects pertaining to the Association.

Reduction of Capital.—A petition for reducing the capital of the British Aluminium Co. is to be heard before Mr. Justice Buckley, in London, on June 7th.

Electrical Trades Union.—On Monday last the Central Branch of the above Union celebrated the opening of a new club room at the "Mitre," 130, Upper Street, Islington, by a grand smoking concert. A large audience enjoyed the programme, which was arranged and carried out under the direction of Mr. Grover, of the Lambeth Branch.

Catalogues and Lists.—THE BERLINER TELEPHONE MANUFACTURING CO. have just issued a new pamphlet (No. 68), in which they illustrate, briefly describe, and price in the course of 16 pages, their various types of domestic telephone instruments for table and wall use, central station "reply and call system," magneto call and intercommunication instruments, also telephonic accessories.

MESSRS. MATTHEWS & YATES, LTD., of Swinton, have issued a small leaflet indicating the variety of electric fans, &c., which they are now exhibiting at the Bradford Exhibition.

MESSRS. GENT & Co. have issued a descriptive leaflet of their patent water-tight contacts for use with water-level alarms. They are made for indicating high water, low water, and both high and low, and are so arranged that the bell which is used for the alarm can be stopped ringing, but the signal showing that the water has reached the mark, cannot be replaced until it has again fallen below the high water mark, or risen above the low water mark, as the case may be. Thus, while preventing the batteries running down by the bell continuously ringing, it avoids the other danger of the attendant resetting the signal without stopping or starting the pumps. Messrs. Gent & Co. have also issued a special catalogue of indicators and recorders for showing the rise or fall of the water inch by inch as it may occur.

MESSRS. F. & C. OSLER, of 100, Oxford Street, W., have issued a 40 pp. list of some of their designs for electric light fittings. The designs shown are extremely pleasing, and they are but specimens of the larger selection contained in the firm's full catalogue.

MESSRS. CROSSLEY BROS., LTD., whose London office is at 10, St. Bride Street, E.C., are manufacturing several different types of producer gas plants, and they have issued a series of circulars giving information relating to them. One of the lists details their new type of suction gas plants for small powers (from 5 to 150 B.H.P.); others describe the patent "A" and "B" types of gas plant, the former for anthracite coal and the latter for bituminous coal or slack.

We have received from the EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., another batch of literature, comprising catalogue section IX. (electric bells, &c.) and some leaflets. The Bell catalogue (green cover) has been restricted to all the chief selling lines. The catalogue, which is nicely printed, deals with various qualities of bells on wood bases, cheap metal-framed bells, continuous ringing and "Whittington" bells, and other types, including high class mining bells. Indicators, pushes, bell pulls, burglar alarms, and bell switches are also particularised. With regard to batteries, the "Ediswan" dry battery, and the "O. K." dry cell, figure prominently, while Leclanché cells of the ordinary and agglomerate types are also listed. Linesmen's detectors are shown with and without dry cells; also the necessary bell wires and other accessories. The catalogue concludes with a lucid explanation of the action of the electric bell, and also with three pages showing diagrams of electric bell circuits; these should be useful for the small wireman. The leaflets comprise No. L. 2,033, describing the Linolite system of lighting; A. 2,034, showing reduction in prices of the "Economic" fuseboard; two leaflets of domestic telephones; and a supplementary page to catalogue section VI., illustrating some quaint electric light brackets constructed of hand-made fret metal, inlaid with mother-of-pearl.

MESSRS. FALK, STADELMANN & CO., LTD., have placed in our hands a copy of their bound catalogue of electrical supplies. This book embraces the whole series of books relating to the firm's electrical department, comprising bells, telephones, lighting accessories and lighting fixtures, wiremen's sundries, electro-medical apparatus, table decorations, artistic electric light fittings, &c. The volume has been prepared in this form with a view to making the component lists convenient for handling. Members of the trade can obtain a copy of this well-illustrated and strongly-bound catalogue on application at 83—87, Farringdon Road, E.C. The different sections can be had separately if desired.

MESSRS. L. ANDREW & CO., of Manchester, are sending out a price list of stoneware insulators, also a sheet showing styles, sizes, &c.

From the BLAKE & KNOWLES Steam Pump Works of Queen Victoria Street, E.C., we have received a copy of their 1904 special catalogue of condensing apparatus for stationary and marine engines. Full particulars and illustrations of various designs of plant are given, including air and circulating pumps, jet condensers, vacuum pumps, exhaust relief valves, feed heaters, oil separators, &c.

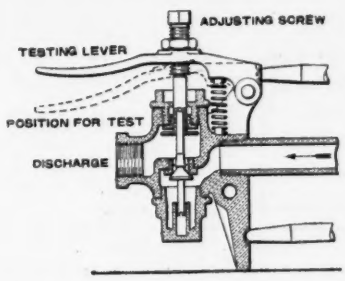
The GENERAL ELECTRIC CO., LTD., have lately brought out their Section S catalogue, which details branch switches, fuses, cut-out boards, ceiling roses, lampholders, Robertson lamps and Nernst lamps. Several of the well-known G.E.C. types of switches, fuseboards, &c., are again shown embodying improvements which have been made from time to time to bring the different patterns up to date. In the fuseboard pages, the spring type of fuse is listed in most cases. Particulars and prices are given of the newly-designed "Quadrant" switch, which is having a first-class run. The porcelain used throughout the fittings shown in this list is of British manufacture. Some pages are devoted to the "Robertson" and "Nernst" lamps. Reductions have been made in the prices of the former.

Lists of the "Kramos" automatic safety starters have been issued by the BATH ELECTRIC MANUFACTURING CO., LTD., of Bath.

The A.E.G., Berlin, send us a list of multiple Nernst lamp fittings, each containing three burners, which can be switched on separately or together. They are arranged for 100-160 volts, 3 or 6 amps., and 200-260 volts, 1·5 or 3 amps.

Motor-Driven Capstans.—Messrs. W. A. Baker & Co., Ltd., of Newport, have placed a contract with Messrs. Walker and Hodgetts, Ltd., of Salford, for one 3-ton electric motor-driven capstan.

Brooke's New Steam Trap.—Messrs. Holden & Brooke, Ltd., of Sirius Works, West Gorton, who have had very lengthy experience in steam trap construction, have brought out a new trap which embodies numerous improvements, which their practical experience has shown to be necessary. The usual trouble experienced by users of steam traps is, that the traps do not discharge positively the whole of the water immediately it collects in the steam pipes, and also that they invariably dribble. It is claimed that Brooke's new trap clears out the whole of the water at each discharge as soon as it collects, and that it cannot dribble. With a dribbling trap one cannot be sure whether the whole of the water, or merely a portion of it, is being discharged. The chances are that merely a portion is being discharged, and that the remainder is gradually backing up in the pipes. The valve and seat of the Brooke trap, which prevent the dribbling, are constructed on the firm's "Protected Seat" principle; that is to say, in addition to its ordinary or main seat, a second or supplementary seat of smaller area, and at a less angle to the axis is provided. This supplementary valve opens much more slowly than the main valve, and thereby prevents the water from



Brooke's New Steam Trap, with Section of Valve.

discharging until it has removed sufficiently far from its seat, not only to prevent dribbling, but also the cutting of the valve faces. The trap opens and closes with a definite stop and start action, *i.e.*, not gradually as in a dribbling trap, and once it is open it does not close until all the collected water is blown out. A large discharge, size for size, is effected by the full opening of the valve, and sudden flushes of water can therefore be dealt with, thus removing a great source of danger; again, foreign particles, such as waste, grease, &c., which in the case of gradual opening traps invariably stick in the valve and choke it, are, in this new trap, readily blown out. It is said that the only part that may ever require renewal is the valve E, which can be removed in a few seconds at any time, without breaking any pipe joint, and replaced by any repair shop. The trap is provided with a hand blow through, and as supplied from stock will work at 5 lbs. or 200 lbs. pressure, and has a working range of 120 lbs. without adjustment. A special heavy pattern is made for pressures up to 300 lbs. The trap has already been tried by a large number of engineering firms, and electricity works engineers, and many orders have been placed.

Duties on Manufacturers' Circulars and Price Lists.—At a meeting of the Manufacturers' Section of the London Chamber of Commerce, held on the 9th inst., Mr. R. J. Lake presiding, a discussion took place on the subject of the duties alleged to be levied in Canada, Australia and India on manufacturers' circulars and price lists forwarded through the post. After discussion it was resolved unanimously:—

That the Section, having regard to the information received from the Colonial Governments with reference to the levying of duty on advertising matter sent from this country to the Colonies, is of opinion that in the interest of traders the British Post-Office Guide should be revised up to date or corrected by special notice pending the next edition.

The Section on November 24th, 1903, passed the following resolutions:—

That in the opinion of this Section it is desirable that the Secretary of State for the Colonies, the Secretary of State for India, the High Commissioner for Canada, the Colonial Chambers of Commerce, and or Boards of Trade of the Empire, be approached with reference to the unsatisfactory position of British manufacturers desiring to circulate their trade catalogues in the Colonies, owing to the onerous regulations in regard to, and the levying of duty on, advertising matter sent by post from Great Britain, and that it is desirable in the interests of trade within the British Empire that advertising matter in the form of trade catalogues or circulars should be admitted free of duty, when sent in single copies to addresses in the Colonies.

That in the opinion of this Section the free admission of trade catalogues and circulars would be of mutual benefit to trade within the Empire, and assist in its development, and that it would result in a larger revenue being obtained from such increase of trade as would fully compensate the various Colonial Governments for any loss of revenue in the remission of the duty as suggested.

These resolutions had been acted upon, and the different authorities concerned had been approached, with results which were placed before the meeting held on May 9th.

Motor Installation at Electrotyping Works.—Messrs. B. Dellagana & Co., Ltd., the well-known electrotypers, recently decided to equip their works at Salford throughout with electric motors. In view of the reduction in the price of energy supplied by the Salford Corporation, it is anticipated that a material saving in labour and cost of power will be effected, apart from the greater convenience in running and cleanliness in their works and equipment. The plant consists of an electroplating dynamo, engraving machines, planning and routing machines, saws, and arc lamps for photographic processes. The dynamos are being driven by separate motors, and the machinery is divided up into sections, each line of shafting being driven by a separate motor. The motors consequently are small, ranging in size between 1 and 3 H.P. By this arrangement, according to the Salford Corporation conditions, they are able to take a 220-volt supply, the motors being equally distributed on both sides of the three-wire system. The contract for the motors and switchgear has been placed with Messrs. Walker and Hodgetts, Ltd., of Salford.

Exports of British Electrical Machinery.—Rather a quiet tone is prevailing in the export trade in British electrical machinery; during April last the value of the shipments amounted to £33,854, as against £34,314 in the corresponding month of last year, while for the four months ending with April last, the returns show a total of only £129,157, which compares with £147,569 in the first four months of 1903.

Trade Announcements.—Increased business has led Messrs. Cecil Hodges & Co. to remove their offices from 52, Queen Victoria Street, E.C., to Balfour House, Finsbury Pavement. The firm has also greatly extended its works at Millwall in order to cope with the demands for switchboards, instruments, &c.

The British Admiralty has placed Messrs. Willans & Robinson, Ltd. (boiler department), on it list as manufacturers of seamless steel tubes. The company have equipped their tube works with powerful presses in connection with the manufacture of the large solid-drawn Niclausse headers, and are in a position also to supply seamless steel tubes up to 18 in. diameter or 14 in. square.

The sole agency of the Electric and Ordnance Accessories Co., Ltd., for motors, dynamos, starters, &c., for London and district is in the hands of Mr. F. W. Jenkins, of 140, Leadenhall Street, E.C. Mr. Jenkins will furnish catalogues, &c., on application.

The May-Oatway Fire Appliances, Ltd., is now opening branches in Liverpool, Birmingham, and Leeds. The success of the company has led it to appoint a manager for Scotland, who will relieve the directors of the company, and enable them to turn greater attention to the development of Lancashire, Yorkshire, the Midlands, and Ireland, from the three cities referred to.

Wolverhampton and Electrical Trade.—In the annual report of the Wolverhampton Chamber of Commerce, just issued, there is the following reference to the electrical trade:—

The electrical business may be said to have entered upon its greater stage. A number of the principal railway companies are applying electricity for driving their main suburban trains. The Lancashire and Yorkshire, Great Northern, Great Western, Metropolitan, and Metropolitan District Companies have put down, or are committed to put down, installations for the driving of parts of their systems, and there is a large extension in the use of electricity for tramways. Great centres of power distribution are being established all over the kingdom. This has given a great fillip to electric and dependent branches of engineering, and has brought into favour steam turbo-generators for large unit installation, which has largely modified the electrical engineering problems. There is considerable business moving in the country at the present time, and there are indications that great extensions of the use of electricity in every branch may be looked for in the immediate future. Local firms are well supplied with orders, and there are being established a number of other very large manufacturing centres. It may be hoped that this country will be fairly well represented in the electrical industry of the future. . . . The trade in electric conduit tubes and fittings has increased during the year, and promises to develop into a large industry, as the outcome of the greater use of electricity throughout the country, and it is gratifying to report that a fair proportion of this new trade is being done by local manufacturers.

Dissolutions and Liquidations.—The estates of A. S. Johnstone & Co., electrical engineers, Glasgow, and of A. S. Johnstone, sole partner, were sequestrated on May 10th. A meeting to elect the trustee and commissioners is to be held at the Faculty Hall, St. George's Place, Glasgow, on May 20th.

The Electric Light Insurance and Maintenance Co., Ltd., is winding up voluntarily, with Mr. Elles Hill, 79, Mark Lane, E.C. as liquidator.

The Electrical Inkless Printing Syndicate, Ltd., is winding up voluntarily, with Mr. A. J. H. Robertson, 20, Bucklersbury, E.C., as liquidator.

A meeting of the Boiler Insurance and Steam Power Co. is to be held at Manchester on June 20th, to hear an account of the winding up from Mr. E. Hadfield, the liquidator.

Under the winding-up order recently made against the Automatic Telephone Co. (1903), Ltd., the statutory meetings of the creditors and shareholders were held on Tuesday at the London Bankruptcy Court, before Mr. Wincarls, Assistant Official Receiver. The proceedings at the meeting of creditors were merely of a formal character, the chairman stating that as the assets were likely to produce sufficient to pay the creditors 20s. in the £, this had to be regarded as a shareholders' liquidation. A resolution was unanimously passed for the Official Receiver to act as liquidator with the assistance of a committee of inspection. The chairman reported to the shareholders that the winding-up order was made on March 15th, on the petition of shareholders presented on February 9th last. A statement of affairs had been submitted by Mr. Max Margowski, the late managing director, but the secretary to the company had declined to concur with it on the ground that no books of account had been kept. The statement showed unsecured debts £275 5s., but proofs amounting to over £1,100 had been lodged, the excess being due chiefly to the fact that Mrs.

Margowski having valued her securities at a lesser amount than the value placed upon them in the statement of affairs. The assets consisted of cash at bankers, 5s.; shares in patents, £4,100; and unpaid calls estimated to produce £85 7s. 6d. The patents consisted of a half share in an electrical fan, valued at £3,000, and an interest in a patent electrical chuck and tool-holder, valued at £1,100. The shareholders would observe that the patents for which this company was formed or reconstructed, were not returned in the statement of affairs as being of any value at all. The account with the contributories disclosed a deficiency of £10,051. The company was registered on January 10th, 1903, as a reconstruction of the Automatic Telephone Co., Ltd., which was formed in July, 1897, to take over the assets of the Apostoloff Automatic Telephone Parent Syndicate, Ltd., which had been registered in November, 1895, to acquire the invention of S. B. Apostoloff for an automatic telephone exchange, which was to do away with the necessity for the present system of telephone exchanges. The £10,000 capital of the syndicate was issued as to £6,500 in fully-paid shares to Apostoloff, and the remainder for cash. The Apostoloff system was tried in Paris, and was found to be defective, but improvements were suggested by M. Seligman Lui, an electrical engineer in the employment of the French Government, who took out patents to protect these improvements. With the object of acquiring these patents and the services of M. Seligman Lui, the syndicate was reconstructed under the name of the Automatic Telephone Co., Ltd., Mr. Margowski, the promoter and managing director of the syndicate, becoming the managing director of the company. Under an agreement, dated July 7th, 1897, the company gave Mr. Margowski very wide powers of management. The nominal capital of the Automatic Telephone Co., Ltd., was £100,000, divided into 400,000 shares of 5s. each. It was not clear, exactly, how many shares were issued in that company, as the books were incomplete, but in addition to the shares allotted as fully-paid to the shareholders of the Apostoloff syndicate, M. Seligman Lui received 40,000 fully-paid as consideration for his patents, and a number of shares were apparently subscribed for and allotted at 3s. per share paid. That was a matter which would have to be explained. The signatories subscribed also for 26,440 shares. Most of these were subscribed for by Mr. Margowski and the Honduras Banking and Trading Co., Ltd., of which Mr. Margowski was the managing director. The exact terms on which the signatories to the memorandum subscribed for shares were the subject of discussion—and he might say dissension—between the directors. That was also a matter calling for investigation. The preparation of a working model by M. Seligman Lui took a very considerable time; in fact, the model did not arrive in London until early in 1902. The rest of the year was spent in experimenting with it, and there were various disputes between M. Lui and the directors, as well as between the directors and the shareholders. Apparently the Automatic Telephone Co., Ltd., received in cash about £8,720.

Mr. G. S. Barnes, the senior Official Receiver and liquidator of H. M. Salmony & Co., Ltd., is applying to the Board of Trade for his release. He reports that the goodwill was advertised for sale by tender, but unsuccessfully, and upon the valuer's advice a private offer was accepted for the stock. "The question of H. M. Salmony's liability in respect of his qualification shares was considered, but it was not deemed advisable to institute any proceedings against him. With regard to the sum of £132 10s. 6d. paid to the directors for fees, without the formal authority of the shareholders, it was found upon inquiry that the amount was made up of various small sums paid to the directors for services rendered. In these circumstances it was considered that any efforts to recover the amounts would have been futile. As explained in the Official Receiver's observations on the statement of affairs, the whole of the company's assets were mortgaged to debenture-holders, but in view of the circumstances in which the debenture held by Ernest Rosenberg and others was transferred to the Stewart Electrical Syndicate, Ltd., at a time when Rosenberg was alleged to be indebted to the company in a large amount, the validity of the debenture was questioned. Subsequently a division of the net assets was arranged with the debenture holder and sanctioned by the Court. The question of the indebtedness of Ernest Rosenberg to the company was referred to counsel. Though no discharge of such indebtedness appeared by the documents to have been given by the company, counsel was of opinion that in the circumstances no further proceedings to contest the point were advisable; none were therefore taken."

Brush Contracts.—The Brush Electrical Engineering Co., Ltd., have secured the following contracts:—

City of Birmingham Tramways Co.—12 complete double-deck cars with Brush equipments and radial trucks, and eight radial trucks.

Birmingham and Midland Tramways Co.—Six double-deck cars with Brush equipments and trucks.

Birtley Ironworks Co.—400-KW. Brush reciprocating enclosed engine and dynamo.

Corporation of Derby.—Series of direct-current motors of various sizes.

Bankruptcy Proceedings.—The statement of affairs in *re* David Todd Cameron, mechanical and electrical engineer of Saltash, Cornwall, shows the assets (as estimated by the debtor) at £49 less creditors for preferential wages (£21), and there is a deficiency of £184 13s. 4d. Undue competition and cutting of prices are the causes of insolvency.

On May 12th a receiving order was made against Wm. Wenham, electrical engineer, Croydon.

On May 11th a receiving order was granted on a creditor's petition against J. J. and H. K. De Lacy (De Lacy Bros.), electrical engineers, 58, Old Hall Street, Liverpool. The first meeting and public examination are to be held on May 25th and June 2nd respectively at Liverpool.

Book Notices.—"Transactions of the N.E. Coast Institution of Engineers and Shipbuilders," Vol. xx. Session 1903-4. Newcastle-on-Tyne: The Secretary of the Institution.

Prospectus of "The Working Men's College for 1904." Melbourne.

"Analysis of the Accounts of the Electricity Supply Undertakings (Company and Municipal) in the County of London for 1902-3." By the Local Government and Statistical Department of the L.C.C. Westminster: P. S. King & Son. 5d.

"Mechanical Drawing Simply Explained." By F. E. Powell. "Patents Simply Explained." *The Model Engineer* Series, No. 20 and 21. London: Percival Marshall & Co. 6d. each net.

"Electric Lighting Accounts." By George Johnson. London: Gee & Co. Price 5s. net.

"Modern Machine Shop Tools." By W. H. Van Dervoort. London: Crosby Lockwood & Co. New York: Norman W. Henley Publishing Co. Price 21s. net.

Lieber's Manual. Lieber Code Co., 97, Queen Victoria Street, E.C. This is No. 155 of the Manual, and it is really a directory of the firms and others using Lieber's standard code (English and French edition) at the date October, 1903.

Economic Aspects of Electric Power Distribution.—We have received from Mr. Edmund L. Hill, M.I.M.E., A.M.I.E.E., general manager of the South Wales Electrical Power Distribution Co., a pamphlet, by himself, dealing with the economic aspects of electric power distribution. Mr. Hill sketches briefly the why and wherefore of the Power Co., showing that it can supply energy at far cheaper rates than is possible for concerns whose primary function is electric lighting. We might call the author's attention to a slight inaccuracy on page 4, where he refers to the operations of a company at Bradford; possibly he meant the Yorkshire House-to-House Electricity Co., at Leeds.

"Pantasote" Electric Car Blinds.—Messrs. Wm. E. Peck & Co. (Inc.), 8, Bradford Avenue, E.C., are introducing "Pantasote" material for car blinds. The material, we understand, is widely used in the United States, and has been in use on many of the principal railroads for some years past. Pantasote is claimed to be sun-proof and water-proof, as well as being desirable from a sanitary point, inasmuch as its surface cannot harbour germs or dust. It is said to be also practically fire-proof, in that it will not support flame. It is produced in a variety of handsome designs and colours. Pattern books and full particulars may be obtained on application to Messrs. Peck.

Engine Contract.—Mr. A. Moir has placed an order for two Sisson engines of 60 B.H.P. each, with Messrs. W. Sisson and Co., of Gloucester.

Imports of Telegraph Cables.—The imports of foreign telegraph cables and apparatus connected therewith into this country during April last amounted to only £1,281, as compared with £2,512 in the preceding month and £2,643 in April last year. The aggregate of such imports during the four months ending with April is returned at only £10,527, as contrasted with £25,639 in the corresponding four months of 1903.

Belgium.—The Antwerp Telephone and Electrical Works reports a profit of £2,099 for the last financial year.

LIGHTING AND POWER NOTES.

Barnsley.—In regard to the recent proposal to increase the arc lighting, it was stated that the charges per light per annum could be reduced from £12 10s., as at present, to £9 10s. The present cost of 140 gas lamps, including the hire of standards, is £289 per annum, and the Council proposes to substitute for these 54 arcs, which it is stated would cost, including the hire of standards and the saving due to the reduction in price on the present arcs, £346 per annum, a difference of £57, increasing the revenue of the electrical undertaking by £429. The capital cost, not including mains, is estimated at £750.

Bath.—The E.L. Committee states that the income from the sale of energy and public lighting for the year ending March 31st, 1904, has been £16,102, against £14,199 in the previous year, only £170 of the increase being for public lighting. The total revenue was £16,665, against £14,953. The total expenditure was £8,967, against £9,047, but in the previous year £871 was charged for the renewal of machinery, &c. The gross profit balance is £7,652, against £5,895. The unappropriated balance of the previous year's account was £1,233, making £8,886 in all. The interest on and repayment of loans absorbed £6,584, leaving the Committee £2,302 to allocate. £1,233 has been placed to a reserve fund, and £1,068, the profit on the year's working, carried forward. The reserve fund has a charge against it of £420, the cost of the opposition to the Somerset Power Bill, so that the balance on that account is £813.

Belfast.—The report of the working of the E.L. undertaking for the year ending March 31st last shows a gross profit of £17,558, or, after deducting interest and sinking fund charges, &c., a net profit of £6,128. The total cost of production, exclusive of interest and sinking fund, now stands at 1·032d. per unit. The electrical energy sold during the year came to 2,255,579 units, as compared with 1,665,560 units in the previous year. A large amount has, it is stated, been written off against depreciation of the Chapel Lane property.

Birmingham.—A L.G.B. inquiry into the application of the City Council for leave to borrow £447,129 for electrical purposes was held on 17th inst.

Bredbury and Romiley.—The B. of T. has written to the U.D.C. asking what steps have been taken to carry out the E.L. Order of 1900. As a result the Council has appointed a committee to interview the Stockport T.C. on the matter.

Bridgnorth.—It was reported at the meeting of the T.C. on May 11th, that the B. of T. had declined to grant a private company a prov. order for E.L., owing to the opposition of the local authorities interested in the matter.

Caerphilly.—The U.D.C. has obtained powers to distribute electricity supplied to it in bulk.

Dalkeith.—Messrs. Crompton & Co., Ltd., London and Chelmsford, who are introducing the electric light into Dalkeith and several other towns in the south and west of Scotland, have made a demand on the Town Council of Dalkeith, to give a guarantee of 3,000 hours per annum for the lighting of the street lamps. The T.C. is not disposed to give the guarantee, and desires, if possible, to secure certain terms for the lighting of public buildings, such as were granted to Dumbarton; to this Messrs. Crompton have demurred. They also state that, according to agreement, their wishes in the matter of guarantee must be met, or the question submitted to arbitration.

Dawley.—The B. of T. has informed the U.D.C. that the Mid-Shropshire E.L. prov. order will not be proceeded with.

Dewsbury.—Complaints have been made about the Corporation's charges for electricity, which are said to be higher than those of other towns. It is also urged that meter and indicator rents should not be charged.

Dover.—The purchase of the undertaking of the Dover Electricity Supply Co. by the Corporation has been completed.

Exeter.—The new generating station at the Basin was officially opened about a fortnight ago; energy has been supplied from this station since November of last year in order to cope with last winter's load. Since April 15th the old works in New North Road have been shut down and the entire supply taken from the Basin works. The plant installed at present includes three Babcock and Wilcox boilers, with superheaters and chain grate stokers, each of 500 H.P.; three 400-KW. and one 100-KW. Belliss-Westinghouse two-phase alternators; Westinghouse motors and transformers and switchboard; Worthington pumps; Green economisers; Musker crane; coal bunkers, conveyers, iron piping, &c., by Messrs. Willey and Co. The boilers from the old station are to be transferred, which will bring the capacity up to 2,700 H.P. The cost of the new undertaking is about £51,500. Plant for the tramways is to be installed within the next three months.

Gillingham.—A L.G.B. inquiry has been held into the application of the T.C. for permission to borrow £20,000 for E.L. extensions. There was some opposition.

Golborne.—The Lancashire Electric Power Co. has informed the U.D.C. that it will be in a position to supply energy in bulk in January, 1905, and asks the Council, if it decides not to take energy from the company, to give consent for the company to supply direct to consumers. A committee is considering the matter.

Gravesend.—At a T.C. meeting it was stated that a list had been obtained of the prices for public electric lighting in 42 towns in England. Out of these, in only one—Watford—was the cost less than at Gravesend, where electricity was supplied at 3d. per unit. The engineer was authorised to institute a system of supply to power consumers.

The T.C. has fixed the price of electricity for power at 5d. and 1d. per unit, and has instructed the town clerk to make inquiries with the object of introducing a free wiring scheme in connection with the use of slot meters.

Harrogate.—The Lighting Committee has recommended the following reductions in the scale of charges for energy:—Flat rate, from 6d. to 5d. per unit; demand indicator system, from 6d. and 3d. to 6d. and 2d.; power, from 2d. to 1½d.

Hastings.—The electrical engineer, as instructed by the Electricity Committee, has laid before the T.C. a report giving the alterations and additions that should be made to the plant at the electricity works. He suggests that the rope-driven set should be discarded, and in place of it a 100-KW. Belliss-G.E.C. set should be installed. The Wright condenser might also be discarded and another 8-KW. exciter erected; the three-crank compound engines of the 200-KW. Belliss-Brush sets should be altered to triple expansion, increasing the output from 200 to 250 KW. running continuously; the makers guaranteed a saving of 15 per cent. by doing this. In place of the condenser, another Wheeler cooling tower should be erected, the two being arranged to work in parallel, by that means improving the vacuum in the steam turbine. The estimate for carrying out this work is as follows:—A Belliss-G.E.C. alternator, £1,094; alterations to the two 200-KW. sets, £593; new cooling tower and alterations to piping, £720; new 5-in. circulating pump with Bumsted engine, £170; 8-KW. exciter with Bumsted engine, £200; new steam main, £180; new storage tank, £150; contingencies, 10 per cent., £310; total, £3,416 10s. The Committee recommends that such proposals be adopted, and that application be made to the L.G.B. for sanction to the borrowing of the estimated amount. The report was adopted by the T.C., but it was decided to let the matter stand over for 12 months.

Heywood.—The Electricity Committee reports that there is a deficiency for the year of £1,339, and the Finance Committee of the Corporation has been requested to provide a sum in aid of this, equal to a 2d. rate on the whole of the borough. The figures do not represent the loss on the year's working, but include a sum brought forward from the previous year.

Hove.—The Hove Electric Light Co. has offered to supply energy in bulk to Aldrington at 4¼d. and 1⅜d. per unit maximum demand, subject to a discount of 10 per cent. when the consumption per annum amounts to 250,000 units. The T.C. has referred the matter to a Committee for consideration.

Huddersfield.—The Corporation has decided not to accede to a request to reduce the price of energy for lighting purposes, but is of opinion that the sum of £5,986, which was obtained from the rates to meet the deficiency during the first three years' working, should be returned. From July 1st the charge for energy for power purposes is to be reduced to 2d. one hour's, and 1d. per unit on two hours' maximum demand, or for half full load on motors for eight hours per day 1d. per unit for all energy consumed.

Kildare.—The Council is advertising for a loan of £3,300 for electric lighting purposes.

Leyland.—The U.D.C. has applied for a further extension of the E.L. Order, which expires on June 1st.

Lichfield.—The E.L. Committee in a report presented to to the City Council recently stated that the B. of T. had refused the application for a supplementary prov. order for the supply of electricity outside the city boundaries, which had been made for the purpose of including Whittington Barracks and the Trent Valley Railway Station. The B. of T. said the L.G.B. had informed the department that the remaining borrowing power of the Corporation was less than the £23,000, and that this was insufficient to cover the £25,000 proposed to be expended. The L.G.B. further stated that the Corporation would probably require to borrow additional sums in the near future for other works. In those circumstances the B. of T., were unable to sanction a loan for an electric lighting scheme of the magnitude proposed. After the receipt of this, a deputation waited upon the two Boards and pointed out that within eight years, eight of the existing loans would fall in, and that the electric lighting works would be carried out in sections, by the completion of which the borrowing powers of the Corporation would be quite ample. The L.G.B. thereupon replied that it would raise no further objection to the issue of the further order. The B of T. however, replied that "it saw no ground for altering its decision." It stated that it had inquired of the Army Council, and was informed by it that there was no intention of adopting electric lighting at Whittington Barracks. With the view, however, of giving the Corporation the opportunity of considering a scheme for the city, the B. of T. intimated that it would defer consideration of the question of revoking that order until March 31st next year. The Committee are preparing a scheme dealing with the powers under the existing Order.

Liverpool.—The Electric Power and Lighting Committee has recommended that an application be made to the L.G.B. for sanction to borrow a further sum of £400,000 for purposes connected with electricity supply.

London.—SOUTHWARK.—The Electric Lighting Committee having considered the report of a sub-committee which has been investigating complaints by consumers as to defective illuminating power, voltage fluctuation and price of electric light compared with gas, and also the reply of the engineer thereto, has recommended that the resident engineer, Mr. Blaikie, be given three months' notice to terminate his appointment.

Mr. NEWMAN, chairman of the Committee, in formally moving the adoption of the report, stated that he entirely dissented from the recommendation. Mr. Blaikie, their resident engineer, had come to them with the highest character, and was in no way to blame for the non-success of the undertaking. In his (the speaker's) opinion success was now within measurable distance, but even if it were not so, it was unfair to attempt to ascribe failure to one man in order to whitewash the Committees who were responsible for five or six years.

Mr. ATTENBOROUGH pointed out that in September last, when Mr. Blaikie was seeking another situation, the late mayor gave him a testimonial for ability, tact and energy, and paying him a high compliment for his control and management of the undertaking. They were doing a great injustice to the head of a department, but Mr. Blaikie had his living to get, and if the insulting recommendation was withdrawn he would resign within three months.

Other members urged that if the course of action proposed by the majority of the Committee were adopted, municipal trading would be injured, as professional gentlemen of good abilities would hesitate to accept places where they might be made the scapegoats of ignorant committees.

Mr. DAWES moved, as an amendment to the adoption of the report, that the consideration of the matter be adjourned for one month, to give Mr. Blaikie an opportunity to resign. The amendment was carried by 23 votes to 15.

Mr. NEWMAN said it was to be distinctly understood that Mr. Blaikie felt he was not in the wrong, and that his offer to resign was conditional on the withdrawal of the Committee's recommendation.

FULHAM.—The Finance Committee of the B.C. has reported that the accounts for the E.L. undertaking show that the previous transfer from the general rate account was not all expended, by £1,177, due to the unexpectedly heavy consumption of energy during the March quarter. This amount, together with the saving on the pre-

vious rate provision, viz., £1,666, made a surplus of £2,842 standing to the credit of the account. The report continues:—"The Council is compelled by the requirements of the L.C.C., to provide a renewals reserve fund out of revenue, and we approve of the suggestion of the treasurer that £2,800 out of the above mentioned surplus should be placed to the credit of the machinery maintenance and reserve account." The engineer has been authorised to extend the mains to the Western Hospital at a cost of £566.

SHOREDITCH.—At the last B.C. meeting the Electric Lighting Committee reported having acquired certain property for £2,700, adjacent to the generating station, with a view to settling an action for alleged vibration and blocking of ancient lights. The area acquired will be used for extensions shortly.

The Lighting Committee also reported having by means of comparative tests, generating by means of coal only, and in the usual way by means of coal supplemented with steam from the destructor plant, fixed a value of ·9d. per unit for energy generated from the latter plant. It was decided to hold an electrical exhibition in the autumn.

POPLAR.—In a report issued on Wednesday the Electricity Committee of the B.C. states that it has decided to adopt raising and lowering gear for use in trimming arc lamps in substitution for the present method by the use of tower ladders. The cost will be 60s. per lamp, or a total of £960, and the net saving after meeting interest and repayments of capital on the sum mentioned, will be £364 per annum.

BERMONDSEY.—At the meeting of the B.C. on Tuesday, the statement of accounts of the electricity undertaking for the 12 months ending March 31st, and the estimates for the forthcoming year were submitted. During the period under review, there was a capital expenditure of £25,014, making the total expenditure under this head £69,266. In the revenue acccount the receipts were £7,974. The expenditure under this head amounted to £5,820. The credit balance of £2,154 from this account was reduced to £509 by payment of £1,588 for interest, and £56 for instalments of principal. For the 12 months ending March, 1902, 18,592 units were sold for public lighting, and 10,301 to private consumers; in the following year 100,165 units for public lighting, and 183,993 to private consumers; last year 199,515 for public lighting, and 330,225 to private consumers. For the 12 months to end March, 1905, it was estimated that the expenditure would be £10,239, and the income £12,091. Motions were passed approving of the estimates, continuing the present scale of charges, creating a reserve fund and transferring thereto £500 of the £509 surplus on the year's trading. It was resolved to increase the salaries of Mr. Vincent, the electrical engineer; Mr. Young, the chief clerk; and others. An agreement to pay £2 per annum to the Thames Conservancy for permission to lay cables across the Lavender Docks entrance of the Surrey Commercial Docks was signed.

Lowestoft.—The T.C. has adopted a flat rate of 5½d. per unit, and has decided to fix no more demand indicators.

Margam.—The D.C. has decided to borrow £5,000 for the electric lighting of the district.

Northampton.—The directors of the electric light company have declined the offer of the T.C. of £100,000 to purchase the electric light undertaking.

Portsmouth.—The scheme being prepared for the Admiralty by Messrs. Preece & Cardew for installing electricity for lighting and power purposes in the Dockyard, also includes the lighting of the Government establishments on the Gosport side of the Harbour, the Royal Clarence Victualling Yard, Forton Barracks, and other parts, and a plot of land has been purchased for the generating station.

Pudsey.—Negotiations are being carried on with a view to a private company taking over the Corporation E.L. order and obtaining a supply of energy from the Yorkshire Electric Supply Co. in bulk at 1¼d. per unit and distributing it in the town.

Radcliffe.—The U.D.C. has fixed the price of electricity for lighting at 5d. per unit, and for power at 2d.

Rhyl.—The U.D.C. has applied to the L.G.B. for a loan of £2,610 for the purchase of new feeders and mains for the electric light.

Russia.—According to the report of the Société d'Eclairage Electrique de Saint Petersbourg for last year, the stations of the company are now supplying energy to 401 arc lamps for public lighting, an increase of 25 on the twelve months, and for private lighting purposes an equivalent of 288,463 10-C.P. lamps are connected, an increase of 54,870 lamps. The output in 1903 amounted to 12,607,963 KW.-hours; incandescent lamps, 89·3 per cent.; arc lamps, 3·7 per cent.; power, 7 per cent. During the year a new 1,000-H.P. turbine and boiler was added to the plant.

Simla.—A hydro-electric scheme for supplying the district with electric light and power has been drawn up by Major-Gen. Beresford-Lovett and Mr. A. H. Pook. It is proposed to utilise the Nauti Khud by dropping its water into the Sutlej, and erecting a water-turbine plant for pumping water to the town, for domestic purposes, and also for supplying energy for electric lighting and power. It is stated that 3,500 H.P. of turbine machinery could be run, and under ordinary conditions 1,679 H P. would be available for electric lighting and power to the town itself. The power transmission lines, including branches to the Charot Nullah pumping station, would run *vid* Halders and Mashobra, and be about 16 miles in length. The estimated cost of the scheme is Rs. 15,36,800, of which about 10½ lakhs would be for water supply.

Standish.—The U.D.C. has asked the Lancashire Electric Power Co. to quote terms for the supply of energy to the town.

Tiverton.—The T.C. has sealed a contract with Messrs. Suter & Co. for the installation of the electric light.

Tunstall.—The B. of T. has intimated that it is doubtful whether it is competent for Burslem T.C. to supply electricity to Tunstall U.D.C. in bulk, unless the Corporation has some special Parliamentary powers of which the Department is not aware. Burslem has intimated its willingness to apply for Parliamentary powers if Tunstall will support it.

Wardle.—The U.D.C. is negotiating with the Lancashire Electric Power Co. for a supply of energy to the district.

Wrexham.—A L.G.B. inquiry was held on the 12th inst. into the application of the T.C. for sanction to borrow £10,570, of which amount £5,600 was for the purpose of extending the E.L. mains.

TRAMWAY AND RAILWAY NOTES.

Birmingham.—A meeting of the Tramways Committee was held on Tuesday, when the report on the scheme for the city tramways was finally considered and approved. No information is to be obtained at present, but the report is to be made public on the 31st inst.

A statement has been in circulation in the local press as to an amicable settlement between Birmingham and Aston with regard to through running of tramways, but nothing definite has been settled yet.

The Cotteridge section of the Birmingham and Midland Tramway Co.'s system is nearing completion, and it is expected will be in running order by the end of the month.

Darlington.—A contractor's trial of a section of the electric tramways took place on Wednesday last week. The public inauguration was to take place this week.

Dewsbury.—Some time ago the system of steam tramways between Dewsbury and Gomersal *vid* Batley and Birstall passed into the hands of the B.E.T. Co. It is the intention of the company to reconstruct and electrify the lines, and it is said the work may be commenced next month. When completed, a junction will be effected with the Spen Valley system at Gomersal, and there will be communication from Dewsbury to Bradford both by the Spen Valley and the Gomersal routes.

Electrical Railway Signalling.—The Great Western Railway Co. have recently completed arrangements for the equipment of a section of their main line, near Didcot, with electrically controlled signals. The necessary motive power will be derived from accumulators situated at each signal post, which will be charged from an adjoining power station. This, the first installation of electrical signalling on the Great Western Railway, is, according to the *Times*, to be completed during the course of the coming summer.

Heywood.—Negotiations are not yet concluded between the several authorities interested in the provision of a through tramway service between Heywood, Middleton, and Manchester. A definite arrangement will, it is hoped, be ultimately arrived at.

Hyde, Stalybridge and Mossley.—The first electric car service on the Stalybridge, Hyde, Dukinfield and Mossley Joint Board's Tramway system was started last week.

Kidderminster.—The Kidderminster and Stourport Electric Tramway Co. have issued, for local consumption, an attractive little excursion guide to the area through which their cars run, including a detailed time-table of cars to Stourport, Birmingham, Wolverhampton, and so on, and a list of revised rates for parcels traffic. It should be a good way of bringing additional traffic to the company's lines.

King's Norton.—The U.D.C. has been successful in obtaining the sanction of the L.G.B. to erect a refuse destructor alongside the site for the tramway power station at Lifford, the estimated cost of which is £9,000.

Leeds.—The financial statement of the city tramways during the year ending March 25th was presented to the Tramways Committee on Monday. The gross revenue for the year was £280,562 16s. 3d., against £265,010 16s. 7d. for the previous year, an increase of £15,551 19s. 8d. This growth, following on an increase of nearly £42,000 in the previous year, has been effected practically without the opening of any new lines, by increasing the car-mileage run in such a way as to meet the public needs. The receipts per car-mile were 10·94d. (10·90d. in the previous year).

On the other side of the balance-sheet, the total working expenses amount to £148,894 18s., against £145,124 18s. for 1902-3, and the gross profit is £131,667 18s., as compared with £119,885 18s., an increase of £11,782. This increase would have been considerably larger but for the fact that during the year an exceptional amount of expenditure on the repair and maintenance of the permanent way has been found necessary. Instead of just over £14,000, as in 1902-3, the outlay under this head has grown to about £22,000. From the gross profit of £131,667 must be deducted £14,874, which is allowed for depreciation; £5,874, the estimated income-tax

charges; £25,606 for interest; and £26,449 for redemption fund charges. These items amount in the aggregate to £72,804, leaving a balance of £58,863. From this the committee proposes to take £6,863 to meet loan fund flotation charges, and to write off the capital cost of battery stations which have been dispensed with, leaving a net surplus of £52,000 available for the relief of the rates, against £62,000 appropriated for this purpose last year.

Light Railways.—Notwithstanding the depression in trade, the applications for power to construct light railways last year did not dry up. The Board of Trade Report, just issued, shows that during 1903 39 fresh orders were received from the Light Railway Commissioners for confirmation, of which 26 were confirmed, in addition to 12 orders held over from the previous year. Confirmation was refused in the case of only one order. Of the remainder 12 were under consideration on December 31st last, but two of these were subsequently confirmed. Since the Light Railways Act of 1896 came into force, 459 applications have been made to the Light Railway Commissioners, of which 257 have been sent to the B. of T. The total number of applications involved a mileage of 4,136 miles, the engineers' estimates for the construction of the same amounting to the substantial sum of nearly £32,017,000. —*Financial Times.*

Newcastle-on-Tyne.—Mr. A. E. Le Rossignol, in his report for the year, gives the following figures:—Car-mileage, 4,059,907, against 3,379,119 in the previous year; receipts per car-mile, 10·94d. (against 10·93d). Total running costs per car-mile, 4·59d., against 4·66d.; total expenditure, 7·19d., against 6·35d. The gross surplus before meeting financial charges is £63,482, against £64,509; £2,957 is deducted for depreciation, against £3,250 last year. Interest charges are £28,896, and redemption fund, £22,638, leaving as the net result a balance of £8,991 to the appropriation account, against £18,400 for the preceding year. In his comments upon the figures, Mr. Le Rossignol says the actual running expenses (inclusive of maintenance) for 1904 came out at a lower rate per car-mile than in 1903, in spite of increased wages to the men, and holidays for which they were paid. In regard to the traffic, he says the adoption of workmen's cars has increased the working expenses, and appreciably affected the revenue. He strongly recommends the committee to take into consideration the abolition of the halfpenny fares, as "without such alteration it will be impossible this next year to realise the income per car-mile that has been assumed in making up the estimates and the balance for 1905 of receipts over working expenses, and capital charges will be reduced if not extinguished altogether. The report was referred to a sub-committee for consideration.

The Corporation Tramways and Parliamentary Committees met a deputation from the Tyneside Tramways and Tramroads Co. on the 10th inst. to consider proposals to end the dispute between the two bodies on the question of running powers. The company submitted two schemes, the first of which was rejected, but the second was more favourably received. This provided for all the Newcastle cars being run to Park Road, Wallsend, instead of stopping at the boundary on either route, either a shuttle or circular scheme being adopted, and standard fares being charged, the company to receive ½d. for each passenger carried over the boundary; the Corporation to allow a car from North Shields to Stanhope Street to be run every 16 minutes with the company's own employés; Newcastle to take entire control of the Gosforth Park line at race times, and pay half fares to the company, the latter being permitted to run cars on their own portion, but not to interfere with the Corporation cars. On ordinary days Newcastle to run a car every half-hour to Gosforth Park, and pay the company half the fares, or, alternatively, to allow the company to run a car to the central station every half-hour. The cars of the company to be reasonably maintained to the satisfaction of the Corporation, and junctions to be made, each party paying half the cost. Power to be supplied by the party on whose system the cars are running. This proposal was considered at length, and, our correspondent understands, generally approved. The meeting stands adjourned.

N.E. Railway.—On 15th inst. preliminary trials of the new electric cars were made between Benton and Tynemouth *vid* Backworth. A six-coach train was run under the control of Mr. Merz and his assistants. A number of the company's officials were on board.

Paisley.—The first section of the Paisley electric tramways, extending from Hawkhead to Paisley, was inspected on Thursday last week by Col. Yorke and Mr. Trotter, of the Board of Trade. At the close the line was declared fit for traffic, and is expected to be opened shortly, when arrangements have been come to with the Glasgow Corporation Committee.

Prestwich.—Salford is seeking by an arrangement with the Prestwich District Council for an extension until August 3rd of the time for constructing a tramway, to connect the lines in Bury Old Road with those in Bury New Road. On the other hand, Prestwich is urging Salford to begin, not later than June 1st, the much needed extension of the lines from the Grand Lodge of Heaton Park along Bury Old Road to Besses-o'th'-Barn.

South Shields.—A meeting of the Tramways Committee was held on the 12th inst. to consider the offers received from Messrs. Rowcliffe & Co., of Manchester, and the British Electric Traction Co., Ltd., for the leasing of the proposed system of electrical tramways in the borough, upon which the town clerk, the borough engineer, the electrical engineer, and the borough accountant submitted reports. The meeting was of a very prolonged character, and our correspondent understands that it was decided that neither of the offers was of such a character that it could be recommended to the Council for acceptance. A suggestion that the undertaking should be municipalised was also considered and negatived, but a notice of motion has been put on the agenda for the next meeting of the Council that the tramways be municipalised. It is understood that the two firms tendering will be asked if they are willing to amend their tenders; if they reply in the affirmative they will be allowed a further period to do so.

Spen Valley.—The Yorkshire (Woollen District) Tramways Co., Ltd., has written the Board of Trade applying for certain directions waiving the carrying out of portions of the original scheme of electric tramways in the Spen Valley (from Hightown Heights, Liversedge, to Cleckheaton). The Liversedge U.D.C. has passed a resolution strongly protesting against any portion of the scheme being abandoned, and the clerk has been instructed to write to the B. of T., and ask them not to accede to the tramway company's application.

Swinton and Pendlebury.—The B. of T. has granted a loan of £26,889 to the U.D.C. for the purchase of the undertaking of the Manchester Carriage and Tramways Co.

TELEGRAPH AND TELEPHONE NOTES.

London and Brighton Telephones.—Lord Stanley, in reply to a House of Commons question put by Mr. Loder, says that the telephone traffic between London and Brighton is subject occasionally to delay owing to some exceptional difficulties in the maintenance of the lines, as well as to the amount of traffic. Steps are being taken to provide additional lines so as to prevent these delays.

The African Direct Telegraph Co.—This company announces the opening of a new land line to the International service in South Nigeria, *vid* Bonny, with offices at Old Calabar, Eket Egwanga.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Dominica-Martinique	May 5, 1902	
St. Lucia-Martinique	May 7, 1902	
Trinidad-Demerara No. 1	Aug. 27, 1901	
Cayenne-Pinheiro	Aug. 18, 1902	
Anjer-Kalianda	Aug. 2, 1902	
Reissa-Issa (Yemen)-Camaran	Oct. 22, 1902	
Tarifa-Tangier	Jan. 18, 1904	
Closed { Nagasaki-Vladivostock	Feb. 15, 1904	
Closed { Port Arthur-Chefu	Feb. 18, 1904	
Foochow-Formosa	Feb. 11, 1904	
Dakar-Conakry	May 13, 1904	
Gibraltar-Tangier	May 17, 1904	
Saigon-Bangkok	May 4, 1904	May 13
Moulmein-Bangkok	May 14, 1904	May 17
Landlines.		
Seoul-Masampo	Feb. 13, 1904	
Seoul-Gensan	Feb. 13, 1904	
Anju-Ping-Yang	Feb. 25, 1904	
Ninguta-Vladivostock	March 2, 1904	

CONTRACTS OPEN AND CLOSED.

OPEN.

Abergavenny.—May 24th. Electric lighting of Monmouthshire Asylum. See "Official Notices" April 22nd.

Argentine Republic.—May 30th. Tenders are being invited until the 30th inst. by the Municipal Authorities of Buenos Ayres for the construction of an electric tramway between that city and Ortuzar, Devoto and General Urquiza.

Batley.—June 2nd. Superheater, piping, valves, &c. See "Official Notices" to-day.

Bolton.—May 25th. Stores for the Electricity Department. See "Official Notices" May 13th.

Canterbury.—June 1st. Boiler, piping, 300-KW. steam dynamo, switchboard and economiser. See "Official Notices" April 29th.

Chili.—June 28th. Electric lighting of the city of Punta Arenas (Straits of Magellan). See this column for February 19th.

Clyde.—May 23rd. Electric wharf cranes for the Clyde Navigation. See "Official Notices" April 22nd.

Coventry.—May 25th. Pipework and a 15-ton electric crane. See "Official Notices" May 13th.

Exeter.—June 9th. Permanent way, overhead equipment, cables and cars. See "Official Notices" May 13th.

(*Continued on page* 837.)

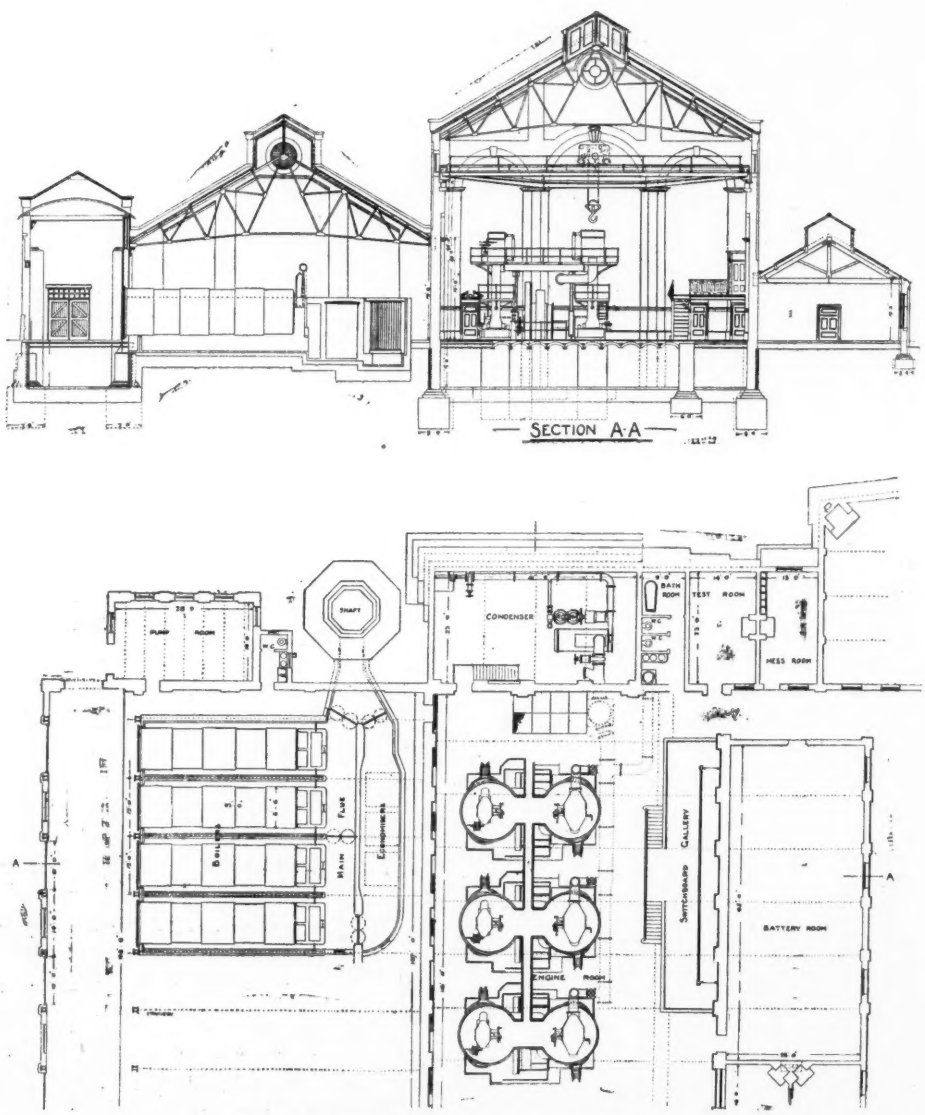
LEICESTER CORPORATION ELECTRIC TRAMWAYS.

On Wednesday last the newly constructed electric tramways of the Leicester Corporation were formally opened for public use by Mr. Councillor Samuel Flint, the chairman of the Tramways Committee. Leicester has been somewhat behind other large towns in bringing its tramway system up to date, being one of the last to adopt electric traction; but, on the other hand, it has had the advantage of being able to profit by the experience of those towns.

The new electric tramway scheme supersedes the old horse tramways, which were originally constructed by the Leicester Tramways Co., Ltd. This company was formed in 1872, and the first line was opened for traffic on December 24th, 1874.

The question of purchase by the Corporation was considered from time to time, and in November, 1899, a Tramways Committee was appointed by the Council, with Mr. Councillor S. Flint as chairman, and Mr. Alderman Thomas Smith, vice-chairman. A sub-committee, with Mr. E. George Mawbey, M.I.C.E., as its chief engineer, and Mr. James Bell, the town clerk, made exhaustive investigations as to the municipalisation of tramways generally, and visited the chief installations in Great Britain and on the Continent. As a result of these investigations, a copiously-illustrated report embodying a comprehensive scheme of electric traction for the town was prepared and issued in November, 1900.

The report embraced the complete scheme now being carried out at Leicester, recommending that the necessary steps should be taken to purchase and work the tramways undertaking by the Corporation, and that the overhead system of electric traction should be adopted.



Sectional Elevation and Plan of Power Station.

Mr. E. Manville, M.Inst.E.E., of the firm of Messrs. Kincaid, Waller, Manville & Dawson, was appointed to report on the scheme, and in his report recommended the whole scheme as submitted to the Council; after opposition to the separate power station had been overcome, it was finally adopted. At the same meeting the Council decided to purchase the existing undertaking for the sum of £134,000.

Mr. Manville was appointed consulting engineer to advise and assist in the preparation of the details of the scheme and during the progress of the works. The Parliamentary plans and estimates were prepared by Mr. Mawbey, and the Bill received the Royal Assent on July 31st, 1902. The Parliamentary estimate for the whole scheme was £537,000, and with £113,000 for street improvements, bridge widening, and side paving, made a total of £650,000.

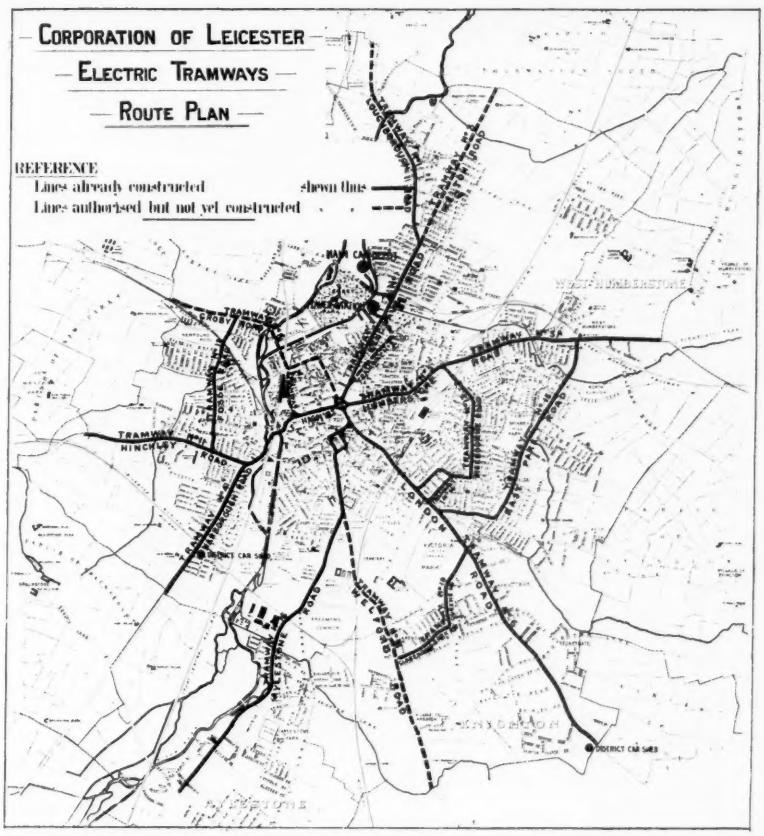
Mr. Mawbey has been the chief engineer for all the branches of this scheme, with Mr. W. Plant as chief assistant for all the permanent way work, buildings, bridge work, &c., and Mr. T. R. Smith as chief electrical and mechanical assistant. Mr. Smith has now been appointed resident electrical and mechanical engineer for running the system.

The scheme sanctioned by Parliament comprises 19½ miles 4 furlongs of double track and 3½ miles of single track, making in all over 42 miles of single track.

The construction of the permanent way and the laying of the feeder conduits was commenced by the Corporation staff in April, 1903; the total length of track which it was decided to carry out immediately, amounting to about 33 miles, was completed in April last, and the remainder is in hand.

The routes comprised in the scheme are moderately straight, with no excessive gradients, the steepest being 1 in 16 for a distance of about 50 yards.

It has been found necessary at considerable expense to lower the roadway under seven of the railway bridges, in one case as much as 2 ft., in order to obtain sufficient headroom for double-deck cars.



A minimum radius of 40 ft. for all curves was aimed at, and with one or two exceptions this has been attained. The gauge of the track is 4 ft. 8½ in.

The rails, which are in 45 ft. lengths, weigh 100 lbs. per yard; they are 7 in. deep and 7 in. across the flange. Cooper's patent anchor, 2 ft. long, has been used on all joints throughout the work. The total depth of concrete under the rails is 7 in., and under the paving 6 in.

Short lengths of interlacing track have been used in Belgrave Gate, Humberstone Road and Aylestone Road. In the latter case this was done in order that the cars might pass under the centre of the arched railway bridge, and thus obtain the maximum headroom. In Belgrave Gate and Humberstone Road this method of construction was adopted at narrow portions of the carriageway, in order that sufficient room might be left for vehicles on either side of the track. Very ample provision has been made for the drainage of the track.

Generally speaking, the track has been paved with 5 in. × 3 in. granite setts from the local quarries, except in the centre of the town, where 9 in. × 4 in. × 3 in. Jarrah and Karri hard wood blocks were used.

The lowest tenders received were for foreign rails and fish-plates, but the Committee determined to accept the lowest of the English tenders, viz., that of the North-Eastern Steel Co., Ltd., of Middlesbrough. This selection has been amply justified, the rails having been supplied fully up to the specification, and giving every satisfaction. There has never been any delay in delivery; on the contrary, the department has always had a good stock of rails in hand. The advantages and facilities thus realised have very fully justified the action of the Committee and the Council in placing their contracts in our own country, where their conditions of labour and other matters could be satisfactorily complied with.

The bolts, nuts, tie-bars and copper bonds were supplied by Messrs. R. W. Blackwell & Co., Ltd.

The whole of the special track work was supplied by Hadfield's Steel Foundry Co., Ltd. The standard points adopted are 12 ft. long, with tongues 7 ft. 6 in., and embodying Hadfield's latest improvements. All the points and crossings are made throughout in Hadfield's patent "Era" manganese steel, each casting, moreover, having a manganese steel renewable centre.

All the lay-outs, including the cross-overs and loops, have been constructed on the floors at Hadfield's works. As regards accuracy in forwarding the various lay-outs, it is creditable to learn that no trouble has been experienced in fitting the work on the road. Particularly was this the case with the Clock Tower Junction. This is claimed to be the largest tramway junction in the United Kingdom, and is a very fine piece of special work. The total weight of this lay-out was over 100 tons, but it was so carefully designed that it was laid by the Corporation staff in 10 days. As seen by the drawing on p. 834, it comprises 10 running tracks, and forms the heart of the whole system. Where the traffic will be heaviest, connected movable points have been adopted.

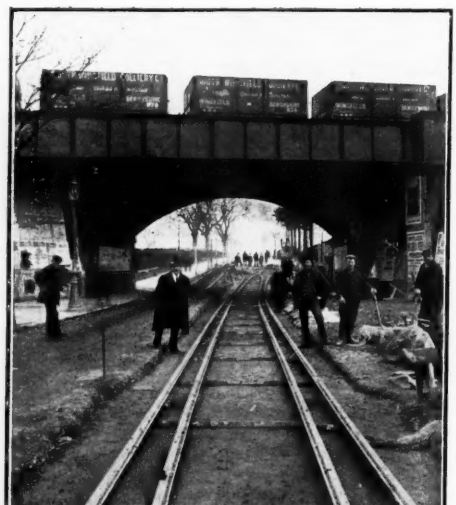
The bonds used are of the solid copper Crown type of No. 0000 B. & S. gauge. Two bonds are inserted at each rail joint. The track is cross-bonded every 40 yards, and the way every 80 yards.

The power station has been erected on a central site at the "Lero," Belgrave Road, and is admirably situated for the delivery of coal either by barge (the canal basin running alongside the boiler house) or by rail, a tramway having been constructed along Painter Street into the power station site.

Special Work at the Clock Tower Junction.

The engine room is 118 ft. long, 60 ft. wide, and 40 ft. high to the eaves. It is well lighted and ventilated, and is lined internally up to the traveller rail with glazed tiles. Moulded tiles are carried round all the arches, with

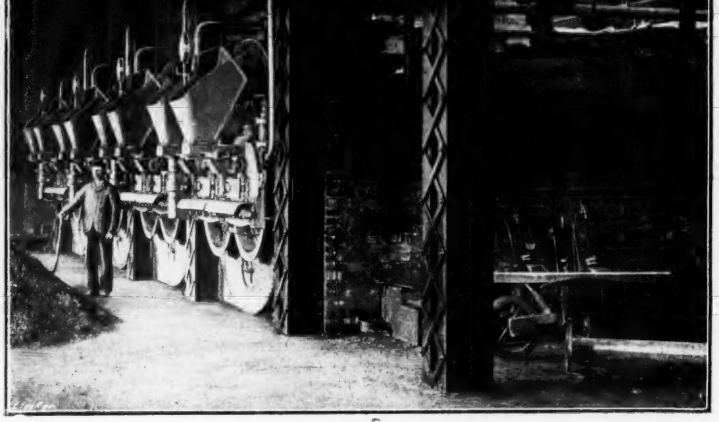
moulded faience blocks under the traveller rail, giving the engine room a very fine appearance. This tiling has been supplied and fixed by Messrs. Maw & Co., of Jackfield, Shropshire. The entrance hall and the floor in the engine room have been laid in mosaic by Messrs. Diespeker, Ltd., of London.



Interlacing Track in Aylestone Road.

Plan of Special Work at the Clock Tower.

Accommodation is provided for the three 500-KW. sets now installed, sufficient extra space being provided for an additional 1,000-KW. set. A considerable area has also been reserved for extending the engine and boiler houses when occasion requires.



Interior of Boiler House.

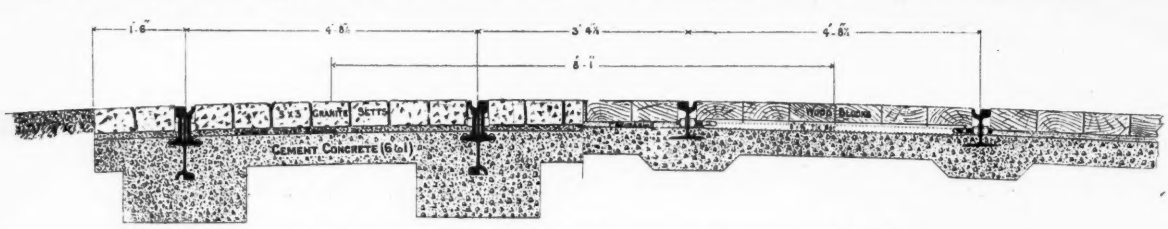
The boiler house is 108 ft. long and 77 ft. wide, providing accommodation for eight boilers, four of which have already been installed. Provision has been made for installing coal bunkers and conveyers over the stoking floor when the number of boilers justifies the expenditure; at present the stoking floor is covered with a temporary corrugated iron roof. The chimney stack is octagonal in shape, 186 ft. high, the internal diameter being 8 ft. 6 in. throughout. It has an independent firebrick lining. The cast-iron cove is constructed in eight sections, each section weighing about 1 ton.

The contractors for the main building were Messrs. Richardson & Son, of Leicester, the steel roofs being let in a separate contract to Messrs. Richards & Son, of Leicester. The contractors for the chimney stack were the Leicester Builders, Ltd.

There are four Lancashire boilers, made by Messrs. Yates and Thom, each 33 ft. long × 8 ft. 6 in. in diameter, and constructed for a working pressure of 160 lbs. per sq. in. They are constructed on the most modern lines, each shell being in 5 rings of one plate each, and were tested satisfactorily to 260 lbs. per sq. in. All the boilers are equipped with Hopkinson fittings, and with stokers of the Bennis type.

Messrs. Yates and Thom also supplied the steam piping, which consists of wrought steel tubes with flanges welded on. The arrangement of the pipes is in the form of a ring main. There is also a very complete arrangement of separators fixed in the main range.

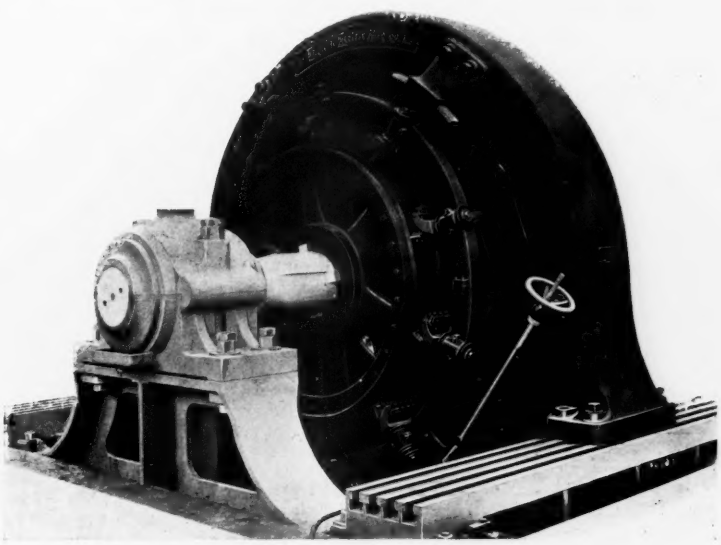
The feed pipes are also of wrought steel, with flanges screwed and riveted, the arrangement admitting of the feed being maintained to any or all of the boilers either direct or through the economiser.



Sections of Track at and between Joints, Showing Granite and Wood Paving.

The feed pumps were manufactured by Messrs. Hall & Sons, Peterborough, and are of their well-known vertical direct-acting type.

The engines are of Messrs. Yates & Thom's vertical cross-compound Corliss condensing type, having cylinders placed at opposite ends of the crankshafts, with the cranks at right angles. The cylinders are 22 in. and 44 in. diameter respectively, with 3-ft. stroke, and the engines run at 95 r.p.m. Each set is rated at 500 KW. normally; the engines are also intended to drive an overload of 25 per cent. for two hours, and sustain overloads of 50 per cent. temporarily.



DICK, KERR 500 KW. DYNAMO.

The cylinders are of the built-up type, with separate ends and barrel; the valves are of the Corliss double-ported type, placed in the cylinder ends. The high pressure cylinder barrel is jacketed with live steam.

The steam valves are worked by Messrs. Yates & Thom's well-known trip gear. The exhaust valves have a plain vibrating motion, derived, like the motion for the steam inlet valves, from eccentrics fixed on the crankshaft. A powerful and sensitive governor is provided, and is fitted with a special safety arrangement which will completely stop the engines in the event of their reaching a speed 10 per cent. above the ordinary working speed, or in the event of any failure of the governing gear.

Each cylinder rests on two massive cast-iron standards with bored guides for the cross-head; the standards are covered in with cast-iron plates in such a way as to completely enclose the moving parts.

The fly-wheel is 16 ft. in diameter, and weighs about 25 tons; it is keyed on the crankshaft alongside the generator, to which it is also coupled by means of turned bolts fitting in a flange cast on the boss of the fly-wheel and passing through holes bored through the generator arms.

A very complete system of lubrication has been supplied, consisting of two ram pumps worked by a drag shaft from the main cranks, and delivering oil under pressure to all the main bearings, the various parts of the engines being protected by oil throwers and covers so as to prevent splashing.

There are three direct-current generators direct-coupled to the Yates & Thom engines, the output of each being 500 KW. at 95 r.p.m., 500 to 550 volts. The machines are of the compound-wound type; they are in every respect in accordance with the standard practice of Messrs. Dick, Kerr & Co. The magnet frames are of cast-iron, the

INTERIOR OF ENGINE ROOM: YATES & THOM ENGINE AND DICK, KERR DYNAMO.

pole-pieces being built of laminated steel cast into the magnet frame.

The armature is built up on a special form of spider, with spacing discs every 3 in. or 4 in. among the laminations to form ventilating ducts. The coils are former-wound, and are interchangeable and readily replaced.

The commutator is built up on its own spider, of hard-drawn copper bars.

The brush holders are designed so that the current does not pass through any moving joints, and are mounted on a massive rocker ring attached to the generator frame; the brushes can be rocked simultaneously by means of a hand-wheel, screw geared to the brush rocker ring.

(To be concluded.)

ELECTRICALLY-DRIVEN MACHINES FOR CHARGING GAS RETORTS.

By E. GUARINI.

Two forms of centrifugal charging machine, worked by electricity, have recently been introduced, one devised by M. De Brouwer, manager of the Bruges Gas Works, and the other by the Paris Gas Co.; these machines are used to charge the gas retorts with a uniform layer of coal of suitable size, at a speed which can be regulated, and without scattering or wasting the material. Besides preventing the formation of dust, which is both unpleasant and injurious to the workmen, a considerable economy of labour is effected by the use of the machines, which can be adapted to all kinds of installations, and combine great certainty of action with a large working capacity.

Fig. 1 shows the machine invented by M. De Brouwer, which consists mainly of a short belt, running over three pulleys at a high speed. A fourth pulley, of larger dimensions, presses on the back of the belt, and forces the latter to follow its periphery for a quarter of a revolution. The pulleys are driven by an electro-motor carried on the machine. The large pulley is of special construction; its contour is grooved in such a way as to form on the part which carries the belt a kind of channel or tunnel. Between the large pulley and one of the others there is a hopper which guides the coal as it falls on the belt from a number of overhead tanks. The coal follows with the belt the path described by the periphery of the pulley through an angle of 90°, being held against the belt by centrifugal force. From the point where the belt leaves the periphery of the large pulley, its direction having been changed from vertical to horizontal, to a point where the belt passes over one of the small pulleys and again changes its direction, the coal remains upon it; but at the latter point the coal leaves the belt and is projected outwards without change of direction. The machine having been placed in front of an open retort, and the belt run up to speed, one of the coal-bins, containing about 150 kg., is opened by means of a lever, allowing the coal to fall through the hopper upon the belt; passing between the belt and the large pulley, as above explained, the coal is projected into the retort, falling there into a layer of even thickness, for, as the coal is projected horizontally, the first portion of the charge passes to the far end of the retort, and the layer is built up from thence, reaching the mouth of the retort at the moment when the last portion of the charge enters it.

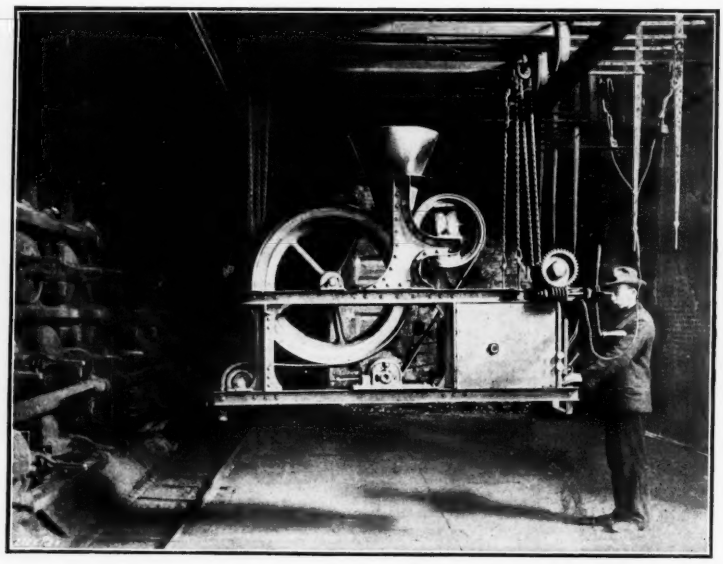


Fig. 1.—De Brouwer Charging-machine.

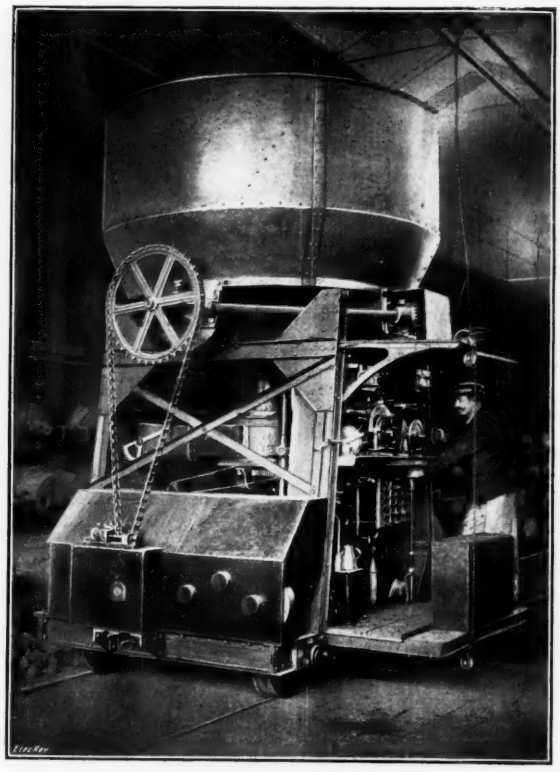


Fig. 2.—Charging-machine of the Paris Gas Co.

In the machine devised by the Compagnie Parisienne du Gaz (figs. 2 and 3) the principal part is a turbine 2 ft. 4 in. in diameter, containing five blades, each formed of two sheets of steel riveted together. The turbine is driven by an electromotor, and the charge of coal is projected by centrifugal force through a nozzle into the retort, where it falls quite evenly. The part of the nozzle projecting beyond the body of the machine is jointed, and when the machine is not in use it is turned back out of the way. When extended it closely approaches the mouth of the retort, without actually entering the latter. Very simple mechanism allows the turbine and spout to be raised and lowered to suit the levels of the different ranges of retorts. On the top of the machine is a hopper holding about 4 metric tons; this feeds the turbine through a telescopic shoot, so as not to interfere with the vertical adjustment of the turbine. When the valve of the hopper is open, the passage of coal into the turbine is regulated by two horizontal archimedean screws. The driving motor is of 12 H.P., and

is mounted so as to rise and fall with the turbine. A second motor fixed on one side of the machine serves to move it along the rails, which are laid to a gauge of 5 ft., on the stoking floor, as well as to drive, by means of gearing, the feed screws. The whole apparatus is mounted on a simple wheeled truck. Electricity is supplied to the machine by means of wires suspended from end to end of the stoking gallery. Apart from bringing the machine into position and starting the turbine, the operator has nothing to do, all the other processes being automatic.

The regulation of the speed is peculiar; at starting the turbine runs at 400 r.p.m., but by the end of the charging operation the speed is reduced to 200 r.p.m. The turbine is started by means of a simple switch, and the speed is gradually reduced by the automatic operation of a rheostat.

The following results obtained with these machines may be of interest. With the De Brouwer machine the charging of the retort takes 13 seconds, and the adjustment preparatory to the next operation, 7 seconds. Thus the three retorts comprised in a horizontal row can be charged in less than 1 minute.

With the Paris Gas Co.'s machine, when the machine is in position, from the moment when the switch is closed to start the turbine to the completion of the charging of a retort 6 m. long with 450 kg. of coal, occupies 30 seconds. The latter machine occupies a space of 7 ft. from front to back, and weighs in all about 10 tons.

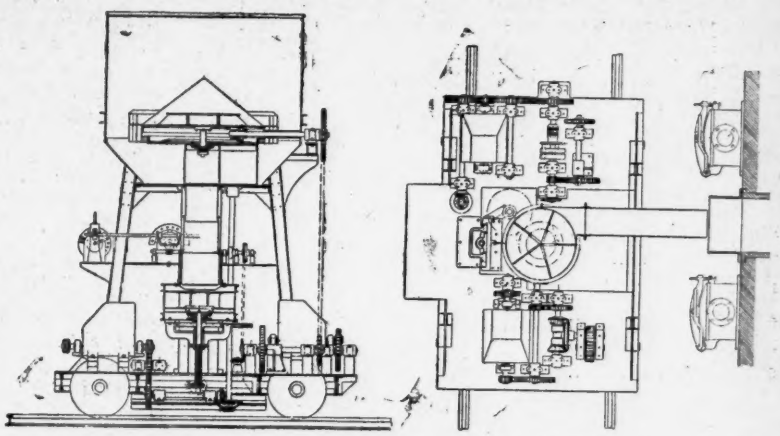


FIG. 3.—DETAILS OF THE PARIS GAS CO.'S MACHINE.

CONTRACTS OPEN.

(*Continued from page* 831.)

Glasgow.—May 23rd. Main cables and electricity meters. See "Official Notices" April 29th.

Hackney.—May 26th. Electricity supply mains. See "Official Notices" April 22nd.

Handsworth.—May 25th. Lighting feeders, mains and roadwork for the U.D.C. See "Official Notices" May 6th.

Handsworth.—June 8th. Erection of generating station. See "Official Notices" to-day.

Holland.—May 31st. Tenders are being invited until May 31st by the Municipal Authorities of Utrecht for the supply and laying of the armoured mains in connection with the municipal central electric lighting station.

Johannesburg.—July 4th. Cables, conductors, and accessories. See "Official Notices" May 13th.

Manchester.—May 25th. Twenty movable electric cranes, for the Ship Canal new dock works. See "Official Notices" April 29th.

May-Oatway Installations.—The May-Oatway Fire Appliances, Ltd., is inviting tenders for installations of its system in Paisley and Edinburgh. See advertisement pages to-day.

Mexborough.—May 21st. Two 100-KW. steam dynamos. See "Official Notices" May 6th.

Partick.—May 24th. Boiler, economiser, pump, condenser, &c. See "Official Notices" May 6th.

Pontypridd.—June 4th. Motors. See "Official Notices" May 13th.

Rochester.—June 3rd. Permanent way and overhead line. See "Official Notices" May 13th.

Rotherham.—May 31st. Cable and meters. See "Official Notices" May 13th.

Royton and Crompton.—May 28th. Overhead equipment and cables. See "Official Notices" May 6th.

Shanghai.—July 30th. The Municipal Council invites tenders for a 24-mile electric trolley line concession. Particulars from J. Pook & Co., 63, Leadenhall Street, E.C., the London agents of the Council. See "Official Notices" May 13th.

Spain.—May 31st. Tenders are being invited until the 31st inst. by the Spanish Post and Telegraph Authorities in Madrid for the establishment and working of a telephone exchange at Elche, with sub-offices at Novelda, Aspe, Monovar, Elda, Pinoso and Crevillente. Tenders are to be sent to La Direccion General de Correos y Telegrafos, Carretas, 10, Madrid, whence particulars may be obtained.

Spain.—May 31st. The Spanish Post and Telegraph Authorities are inviting tenders until the 31st inst. for the supply of 11 kilometres of rubber-insulated six-conductor telegraph cable and 11 kilometres of supporting wire for the Jeronimos telegraph line. Tenders are to be sent to La Direccion General des Correos y Telegrafos, Carretas, 10, Madrid, whence particulars may be obtained.

Sunderland.—May 26th. Stores for the Tramways Department. See "Official Notices" May 13th.

Sunderland.—May 27th. 500-KW. three-phase induction motor-generator for traction purposes. See "Official Notices" May 13th.

Warrington.—May 30th. Mechanical stokers and water softener. See "Official Notices" May 13th.

CLOSED.

Bolton.—The Corporation Tramways Committee has accepted the tenders of the following firms for the supply of electrical equipment and supplies to the Department:—

The General Electric Co.; Messrs. Andrews & Co.; Le Carbone Co.; Messrs. Berkeley & Goodall; Messrs. R. W. Blackwell & Co.; Messrs. Estler Bros.; Messrs. T. Moscrop & Co.; Messrs. D. Priestley & Co.; Messrs. Baxendale and Co.; Messrs. Harland & Jones; Messrs. Taber, Trego & Co.; Messrs. Marsden and Co.; Messrs. Walker & Co.; Messrs. Walmsley & Fisher; Messrs. Dick Kerr & Co.; the Electric Tramways Equipment Co.; Messrs. W. Topp & Co. and Messrs. Fletcher Bros.

Burnley.—The T.C. has accepted the tender of the Erith Engineering Co. to supply six stokers for the electricity works for £486.

Dublin.—The generating plant at Pigeon House having, as already reported, been rejected, a tender at £19,227 to put in new plant has been accepted, and sanction from the L.G.B. has been asked.

Epsom.—The U.D.C. has accepted the tender of the Western Electric Co., for feeder cable at £668; distributors, £608; pilot to feeder, £77, and other cables, £102.

France.—The French Ministry of Posts and Telegraphs has just given out contracts as follows:—La Société Française des Cables Electriques, Lyons, 24 kilometres of telephone cable; Messrs. Aborlard & Co., Paris, 44 kilometres, ditto; La Société Alsacienne de Constructions Mecaniques, Belfort, 18 kilometres, ditto; M. Grammont, Pont de Cherny (Isère), 18 kilometres, ditto; and La Société Industrielle des Telephones, Paris, 27 kilometres, ditto.

Great Western Railway Co.—A contract has been placed with Messrs. Bruce Peebles & Co. for 5,000 KW. in motor-generators, including 10 400-KW. sets, and four 200-KW. sets, spares and switchgear, all to the specifications of Messrs. Kennedy & Jenkin. The motor-generators will be built under the Peebles-La Cour patents.

Heckmondwike.—The U.D.C. has received 185 tenders for the supply and erection of additional plant at the electricity works. A sub-committee has been appointed to go through the tenders and to report.

Liverpool.—The T.C. has accepted the tender of Messrs. Morrison & Son, of Wavertree, for the erection of an electric sub-station in Rice Lane, Walton, at £3,000.

Poplar.—The B.C. has received the following tenders for high-pressure cables, &c.:—

	8 miles cables.	4 miles telephone cables.
Western Electric Co. (recommended)	£2,496	£256
British Insulated & Helsby Cables ..	2,760	288
W. T. Henley's Telegraph Works ..	2,800	288
Siemens Bros.	2,930	280
St. Helens Cable Co.	3,116	293
Callender's Cable Co.	3,232	300
W. T. Glover & Co.	3,280	320
Johnson & Phillips	3,289	304

Additional cables *pro rata*.

For provision and maintenance of battery:—

	Erected complete and maintenance for one year.	Annual charge for maintenance second, third, fourth and fifth years.
Electrical Power Storage Co., Millwall (recommended) ..	£1,860 0	£114
British Battery Co.	1,790 0	£90 1st year, £95 2nd year, £100 3rd year, £105 4th year.
Hart Accumulator Co. ..	1,937 12	£88 18
Tudor Battery Co.	1,972 0	£99
A.B.P. Accumulator Co. ..	2,081 13	£180
D.P. Battery Co.	2,275 14	£146 15
Northampton Battery Co. ..	2,528 14	£50 1st year, £70 2nd year, £80 3rd year, £90 4th year.
Chloride Battery Co.	2,771 0	£152 4

Stockport. — The T.C. has accepted the following tenders:—

S. Fildes & Co., Nernst lamps.
St. Helens Cable Co., for house cables.
Dick, Kerr & Co., Ltd., for a Belliss engine and traction dynamo (including a steam separator), at £2,971.

Walsall.—The T.C. has placed with Messrs. G. C. Milnes, Voss & Co., of Birkenhead, an order for fitting up a sample tramcar with their patent car top at £80.

FORTHCOMING EVENTS.

Friday, May 20th.—At 8 p.m. Junior Institution of Engineers. "Practical Notes on the Running of Motor Cars and Cycles," by Lieut. W. G. Windham.
At 9 p.m. Royal Institution. "The Radiation and Emanation of Radium," by Prof. E. Rutherford, F.R.S.
Saturday, May 21st.—At 2 p.m. at Moorgate Street Station. Institution of Electrical Engineers. Students' Visit to the Great Northern and City Railway.
Wednesday, May 25th.—At 4.30 p.m. (I.E.E., 92, Victoria Street, Westminster.) Annual General Meeting of the Electro-Harmonic Society.
Thursday, May 26th.—At 8 p.m. Institution of Electrical Engineers. The Society of Arts. "High-speed Electric Railway Experiments on the Marienfelde-Zossen Line," by Alexander Siemens.
Friday, May 27th.—At 5 p.m. Physical Society. Meeting.

LONDON MUNICIPAL AUTHORITIES AND THE TELEPHONE PURCHASE QUESTION.

A LARGELY attended conference of local authorities within the London telephone area was held at the Guildhall on Wednesday afternoon, Mr. A. C. Morton being in the chair. The delegates in attendance numbered perhaps a couple of hundred, and represented 76 local authorities. A series of notices of motion had been set down on the paper, but the shape of these was materially altered before they were passed as resolutions. The first resolution was proposed thus:—

That this conference is of opinion that it would be inexpedient for the Government to acquire the undertaking of the National Telephone Co. on any other terms than those set out in the Agreement between the Postmaster-General and the company, dated November 18th, 1901, *and strongly deprecates the increased cost that would be entailed by the proposed acquisition of the undertaking before the expiration of the existing licence in* 1911.

In this form it gave rise to much discussion and disagreement, and ultimately it was thought discreet, in order to preserve the *appearance* of unanimity, that the part that we have printed in italics should be omitted. Several speakers who represented the outlying districts objected to the purchase being delayed, because they were eager to obtain telephonic facilities which are at present lacking.

The second resolution consisted of two of the notices of motion, which were brought together thus:—

That this conference is of opinion, that before any agreement is entered into with the National Telephone Co. for the purchase of their system within the London telephone area, the terms of the proposed arrangement should be submitted for the consideration of the local authorities within that area; and that in the event of Parliament appointing a committee to consider purchase negotiations between the Postmaster-General and the National Telephone Co., the local authorities within the London telephone area should be enabled to submit their views before such committee, and steps be taken to secure accordingly.

Then this meeting, made up of men who knew but little about telephony, began to discuss the question of what was, and what was not, a proper charge for a telephone service. The motion moved by Alderman Ivey, of West Ham, was in the following terms:—

That this conference again protests against the Post Office telephone tariff, being of opinion that the charge for the use of a telephone in the London area should not exceed the sum of £10 per annum for an "unlimited service," and that the other charges for the use of telephones should be proportionately reduced.

This resolution was riddled through and through by the few men present who were sensible enough to admit that they *knew* that they knew nothing about the cost of working a telephone system anywhere, much less in London, or for giving a service to outlying districts. Then, again, why only the "Post Office" tariff should be aimed at was not clear. So here, again, *in order to preserve the appearance of unanimity*, the matters which placed the delegates at loggerheads, and led to multitudinous amendments and motions for adjournment, were deleted, and the following quite harmless and practically non-committal resolution emerged from the cloud of very various amendments:—

That this conference again protests against the telephone tariffs, being of opinion that the charges for the use of a telephone in the London area should be materially reduced.

It is true that this resolution, saying the present charges were too high, was passed unanimously, and with the approval of some who had only a few seconds earlier said that they knew nothing whatever about the cost of providing a service. But that is merely a detail.

Another resolution which was passed without any discussion—and everyone who has used the trunk line service will agree that none was needed—was:—

That in the opinion of this conference the trunk line service is inadequate and unsatisfactory, and requires considerable improvement.

There were other resolutions, which we need not print, whose object was to ensure that the opinions of the conference should find their way to the proper quarter and to arrange that the conference shall meet again when the Government has said what it is going to do now that the London Councils have spoken. Then after thanking everybody who had helped them to hold the meeting, the conference adjourned.

Now, having told the story of what actually took place, may we add the impression which the proceedings made upon ourselves?

One half of the meeting consisted of men who lifted their hands in holy horror at the mention of the Telephone Trust, and were ready to support any proposition which clamoured for something cheaper "for rich and poor alike," irrespective of who should pay for it. Only a few seemed to be aware of the terms of the company's licence and the agreements. Some thought Government purchase would end their troubles, and give them the facilities they wanted; others thought that dual control, as at present, gave better results than would accompany entire Government control; those who agitated for lower rates knew not for what they agitated.

Practically, the chief thing there was anything approaching to genuine unanimity about, was the desire that if there were to be a purchase of the system, the best possible bargain should be made by the Government. And that is really the only point that the Government will give heed to; indeed, we think that the Government could be trusted to make a good bargain in this matter, even without any pressure from municipal sources.

Lectures.—Mr. J. T. Morris is to deliver a series of lectures at the East London Technical College on "Polyphase Work, with Special Reference to Three-Phase Power Transmission," also a series on "Electric Traction." Particulars are given among our advertisements to-day.

NOTES.

South African Notes.—Our Durban correspondent writes:—

Natal Government Railways.—The general manager's report for the year 1903, in referring to the electrical department of the railway, mentions that the new power station is rapidly approaching completion. It is, in the first instance, being fitted with five boilers and four generators, of a maximum output of 1,100 H.P. The power station will be thoroughly modern, and combines in its arrangements mechanical stokers, Green's economiser, superheating apparatus, and condensing plant. Nut coal will be used, at a considerable saving upon the cost of round coal. This power station will supply all the light and power required in the Durban station, yard and shops, including the locomotive yard at Greyville. The Charlestown installation has been brought into use, and is the seventh power station on the Natal railway system. At Charlestown the station buildings, traffic and locomotive yards, and houses for the staff have been, or are in course of being, fitted with the electric light. The Ladysmith plant is now worked during the day for the purpose of driving the machinery in the locomotive shops, as well as the auxiliary pumping plant at the river. Maritzburg new power station has been in successful operation for the major portion of the year. All the machinery at the locomotive yard is worked from this station, and, at night, light is supplied to the locomotive, passenger, and goods yards at both the main station and Victoria.

Pietermaritzburg (Natal) — The Natal Government Telephone Department, in extending their system to meet the growing requirements in the City, are installing a new system of underground cables of the "Helsby" make, a small portion of which came into operation on the 21st inst. The system is very similar to that now being installed in Durban by the Corporation, and it is proposed to run seven or eight cables from the present temporary exchange to the various feeding poles. The number of connections will be doubled, and the "earth" return will be replaced by the "metallic" return, and by the end of June it will have developed into an effective and extensive institution. The formal opening of the operations was witnessed by the Postmaster-General, and the chief engineer and assistant engineer were also present. The trunk line to Ladysmith is in process of construction, and the direct telephone to Durban will not long be delayed.

The Town Council have appointed Mr. P. Finlayson, late resident engineer of Port Elizabeth electric tramways, as manager of their electric tramways, now in course of construction. The discussions in the Council on the routes for the trams still lead to heated arguments, and at the meeting on the 12th inst. strong words were used on the question of a slight deviation being proposed on the Scotsville route, which was, however, carried, thereby making an absolutely direct route with a slightly steeper gradient. The construction work is going ahead well, about two-thirds of the length of track having been laid, except the "points and crossings," which have not yet been delivered; and the pole work is also well in hand.

Johannesburg (Transvaal).—The Tramways Committee of the Town Council have just submitted a supplementary report on the subject of the various routes over which it is proposed to run the electric trams, with a detailed list of the streets in which the track construction is to be immediately put in hand. As is usually the case, protest meetings are being held respecting certain sections, particularly those affecting the Vrededorp district.

Cape Colony.—At a fire inquiry in East London Mr. Alan Gordon, manager of the Sun Fire Insurance Co., stated that insurance companies recognised the danger in electrical installations, but at present there were no regulations throughout South Africa to cope with the danger. A movement was on foot among electrical engineers in Cape Town to get regulations passed, and they were communicating with the insurance companies.

On the recommendation of their Electric Lighting Committee, the East London T.C. resolved that persons who have been supplied by them with transformers in connection with the supply of electric light and power to their premises be given notice that from June 1st, rent will be charged in respect of each transformer at the rate of 12s. 6d. per month.

Orange River Colony.—When the mail left, Mr. Davis, representing Messrs. Davis & Soper, the contractors for the installation of the electric light in Kroonstad, was on a visit to the town, and, in company with Mr. Mumford, had already inspected the site of the power station. Work will be commenced immediately.

The Third Rail Fatality.—As briefly mentioned in our last issue, a fatality occurred on 11th inst. on the portion of the North-Eastern Railway, near Jesmond, which has just recently been electrified, resulting in the death of a child, aged 3½. On 12th inst. City Coroner Hoyle held an inquest into the affair. From the evidence it appeared that the child, while out at play, had got on to the line, near West Jesmond, which the father of the child said had been only partially safeguarded. He saw the child after the accident. It had been injured on the left leg, the flesh having been burned to the bone. The thigh was completely charred. The right cheek was singed; there was a smile on the boy's face, and he appeared to have been instantaneously killed. There was a public road close to the line, and also a bridge, and it was protected only by a horizontal railing. There was absolutely no protection against the conductor rail.—The Coroner said no doubt the child had been trespassing, but there should be more protection than at present, and he should express that opinion to the Home Office.—The jury found that the child had died from the shock and burns consequent on coming in contact with the "live" rail, and expressed the opinion that there should be more efficient protection afforded to the public between the roadway and the line where the deceased met his death.—Mr. Boothroyd, on behalf of the company, expressed their deep regret and sympathy with the parents, and said the observations made would be brought to the notice of the company, and he had no doubt something would be done, which had been done in places regarded as specially dangerous.

Electric Motor Mail Vans in France.—A number of electric motor vans are about to be put in service by the postal authorities in Paris for the rapid conveyance of the mails between the post offices and the railway stations. The vans, which are being constructed by Messrs. Mildé & Co, are designed to carry a load of 12 cwt. at a speed of about 12 miles per hour, as compared with the 8 miles attained by the horse-drawn vehicles. The vans are equipped with a battery of 44 Heinz accumulators, one charge of which will enable the vehicles to cover a distance of about 25 miles.

Claim for Electric Shock.—A youth in the Stepney Electricity Works was recently burned by electric shock. Negotiations have been going on for some time with a view to settling the claim which has arisen out of the affair. Owing, however, to difficulties in the office which guaranteed the Council, no compromise has been effected, and the father has issued a summons in the Whitechapel Court claiming £60 damages and costs.

The Royal College of Science.—The *Times* says that the President of the Board of Education, the Marquis of Londonderry, K.G., has appointed a Departmental Committee to inquire into the present working of the Royal College of Science, including the School of Mines; to consider in what manner the staff, together with the buildings and appliances now in occupation or in course of construction, may be utilised to the fullest extent for the promotion of higher scientific studies in connection with the work of existing or projected institutions for instruction of the same character in the metropolis or elsewhere; and to report on any changes which may be desirable in order to carry out such recommendations as they may make.

Royal Society.—The following were down for yesterday afternoon:—

The Bakerian Lecture, by Prof. E. Rutherford, F.R.S., on "The Succession of Changes in Radio-Active Bodies"; paper by Sir William Ramsay, K.C.B., F.R.S., on "The Spectrum of the Emanation of Radium."

Electro-Harmonic Society.—The annual general meeting of this Society is to be held on Wednesday next, May 25th, at the Institution of Electrical Engineers, 92, Victoria Street, S.W. The report states that, during the past season, 103 new members were elected, 6 members were lost by death, 30 resigned, and 7 were struck off the register. The membership is now 446.

Junior Institution of Engineers.—On Thursday evening, May 12th, a visit was paid by this Institution to the Great Northern, Piccadilly, and Brompton Railway works, the party numbering about 100. They were received, on behalf of the engineers, Sir James Szlumper and Mr. W. Szlumper, by Mr. A. F. Baynham, resident engineer of the South Kensington to Holborn section. Mr. Price was also present on behalf of the contractors for the works.

Leicester Power Station Fatality.—The circumstances attending the death of a carpenter named George Mantle, aged 49 years, who sustained fatal injuries at the Painter Street electric power station on the 11th inst., through being crushed by the fall of two of the marble slabs forming the switchboard, were investigated by the borough coroner. Mr. G. Sedgwick, the factory inspector, was present; and T. Robert Smith, resident electrical engineer, watched the proceedings on behalf of the Corporation. The deceased was admitted to the infirmary suffering from a compound fracture of the skull, death being due to shock consequent upon the injuries he received. The jury proceeded to the power station to inspect the spot where the accident occurred. The evidence showed that a fitter named Cramphorn, and labourer named Evans, had loosened, or taken out, certain holding bolts on the switch panels, this being in excess of their instructions. Two panels subsequently fell on to the deceased, crushing his skull. The coroner reviewed the evidence at some length, and the jury returned a unanimous verdict of accidental death, adding that they did not think there was any culpable negligence, but hoped Cramphorn and Evans would exercise more care in future.

Electric Power in Mines.—The Tredegar Collieries were visited on Monday by a distinguished party representing the German Steel Trust and Westphalian coal trade for the purpose of inspecting the extensive electrical plant at these collieries. The *South Wales Daily News* says that the party comprised Count Von Tiele, Count Victor Eulenberg, Baron Ernsthausen, M. Williger Von Bergmeister Engle, of Essen Ruhr, the manager of a large colliery syndicate in the Westphalian coalfield. The visitors were shown over the surface plant of Pochin Colliery and the underground electric haulage. The plant at Tytrist Colliery, and the surface plant of the McLaren Collieries were inspected.

The Faraday Society.—An ordinary meeting of the Faraday Society was held on Monday, May 9th, at the Institution of Electrical Engineers, Mr. Bertram Blount in the chair. Dr. Charles E. Fawsitt read a paper entitled "Studies in Viscosity," and Dr. F. M. Perkin read a paper by A. Fontana and himself on "The Electrolytic Oxidation of Anthracine."

Leicester Electric Tramways.—On Wednesday afternoon in brilliant weather, the new electric tramway system, of which we commence a description in this issue, was inaugurated. The honours of the day were performed by the Mayor (Alderman Sawday) and the Mayoress. The guests were received at the Town Hall, and they subsequently walked in procession to Horsefair Street, the Police Band playing "See the Conquering Hero Comes" as the Mayor led the way. Our dispatch just to hand from the seat of ceremony does not say so, but we should imagine that the effect of this incident must have been really *immense*. The conquering hero and his host, here boarded 12 cars which took them to the power station in Belgrave Road, which had been choicely decorated. Councillor Flint, chairman of the Tramways Committee, gave some particulars of the undertaking and set the first engine in motion. Alderman Smith set the second engine running. The party was subsequently driven to the car depôt in Abbey Park Road, and later tea was served in the Mayor's rooms in Hastings Street, were some complimentary speeches were delivered.

Australasian Electrical News.—We mentioned last week the visit of a representative of the New Zealand Electric Construction Co. of Christchurch to the States respecting the Christchurch installation. We gather from the *Electrical World* issue to hand this week that Mr. Taylor did not take long to make up his mind respecting what he wanted. He placed the order for the surface condensers and cooling towers for 1,000-KW. plant with the Alberger Condenser Co., the boiler contract with Babcock & Wilcox, and there are to be two 500-KW. Curtis turbine sets.

Messrs. Noyes Bros., a well-known Australasian engineering firm, and representatives of the Westinghouse interests in the above territory, have recently established a branch at 75, Barrack Street, Perth, which is in charge of their engineer, Mr. J. M. Jolly.

Appointments Vacant.—Assistant electrical engineer for Maidenhead (£80 to £100); electrical engineer for Weymouth and Melcombe Regis Corporation (£250); electrical distributing assistant for Belfast (£200); chief assistant electrical engineer for Wakefield (£150).

OUR PERSONAL COLUMN.

[*The Editors invite electrical engineers, whether connected with the power station or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*]

Central Station Engineers.—The Malvern U.D.C. has appointed Mr. W. J. R. BAKER, of the Bolton Corporation Gas Works, as gas and electrical engineer, at an annual salary of £400, with residence.

The employés of the Brighton Corporation Electricity Department went for their second annual walking competition to Lewes and back last Saturday. Mr. C. C. FOWLER, the assistant manager, started the men at 3 o'clock. Every competitor who finished by 7.15 o'clock received a silver medal, and the first three home received silver medals with gold centres. There were also other special prizes. Forty-two entered for the contest.

Mr. WALTER MORLEDGE (28), an electrician, was accidently burned on the face and arms attending to the switchboard at the Birmingham Corporation Supply Station on Tuesday morning.

Mr. FRANCIS THURSFIELD, engineer of the Chester Corporation's electric lighting department, has presented claims against the Corporation for services as consulting engineer. In January it was decided to increase Mr. Thursfield's salary to £550 per annum, rising by annual increments to £700. At the next meeting, however, the Council refused to confirm the increase on the ground that it was excessive. The sequel to this was Mr. Thursfield's resignation. He contends, says the *Manchester Courier*, that the work done was outside his duties as electrical engineer of the town, and on this ground demands payment.

Discussion took place in the Falkirk T.C. on Monday in connection with a proposal by the Electric Light Committee to increase the salary of the resident engineer (Mr. JOHN MCMILLAN) from £200 to £230. The increase was opposed by some members on the ground that the present time—with high rates and dull trade—was very inopportune for raising salaries. Mr. Neilson instituted a comparison between Falkirk and Motherwell, and said that in the latter place, with three times the amount of current sold in the year, the salary of the chief engineer (who was also inspector of lighting) was only £200. Bailie Fairlie (convener of Electric Lighting Committee) traversed Mr. Neilson's statement, and said that the official information the Committee had got from Motherwell was to the effect that the chief engineer's salary was £300. Mr. Neilson said that since the Committee got that information the chief engineer at Motherwell had been appointed to another place, one of his assistants had been promoted, and there was only one assistant now instead of two. In the course of the discussion there was a consensus of opinion that Mr. McMillan was a thoroughly capable and efficient engineer, but it was agreed by a majority of 8 votes to 5 to delay the matter for a month to allow of a statement of the financial condition of the electric lighting undertaking being procured.

General.—We regret to record the death of Captain A. CHAPMAN, of the telegraph steamer *Viking*, which took place at Para, on 7th inst., from inflammation of the stomach. Captain Chapman's connection with submarine telegraphy was a short one, but his long experience during a distinguished career in the service of Messrs. Houlder Bros. enabled him to quickly master the unusual difficulty in maintaining the cables in the River Amazon, and his wonderful energy and absolute integrity secured for him a record which had never before been equalled. The Amazon Telegraph Co. has lost a much valued servant.

We are informed that, at their last meeting, the Council of the Institution of Electrical Engineers elected Major-General C. E. WEBBER (Ret.), R.E., C.B., an honorary member of the Institution. The other honorary members are:—Dr. HENRY WILDE, F.R.S.; the Right Hon. Lord KELVIN, O.M., G.C.V.O., F.R.S.; Dr. J. WILSON SWAN, F.R.S.; Mr. E. MASCART, Membre de Institut de France, and Prof. ANTONIO PACINOTTI, of Pisa. General Webber is one of the founders of the Institution of Electrical Engineers, and a past-president of that body, which was formed in 1871, and now has 5,200 members.

Mr. T. MATHER has changed his address to "Rothsay," Ajax Road, West Hampstead, N.W.

The death has occurred of Mr. WM. HENRY ROBSON, member of the firm of Messrs. Maund & Robson, electrical engineers, of Corporation Street, Southport. He was 41 years of age.

In his speech at the recent meeting of the Eastern Extension Telegraph Co., Sir J. Wolfe Barry referred to the tour being made on behalf of the company by Hon. R. PEEL and Mr. F. E. HESSE. The *Australian Mining Record* for March 31st just to hand, notifies the arrival of these gentlemen in Sydney in the previous week by the steamer *Victoria* from New Zealand. They visited the Cable Bay station, near Nelson, and left by the steamer *Empire* on March 30th for Japan and the Philippines. Mr. W. WARREN, the Australasian manager of the company, journeyed from Melbourne to meet the visitors at Sydney.

The male employés of the National Telephone Co. in the Leeds district went for their annual walk from Roundhay Park to Boston Spa and back. There were 13 starters. The first arrival home was Mr. J. A. DALGLEISH, who covered the distance of 22 miles in 3 hrs. 45 min.

Mr. WM. TATLOW, the secretary of the Dublin local section of the Institution of Electrical Engineers, was last week presented with a pair of silver salvers by the members of the section on the occasion of his marriage.

Mr. HENRY RUFFER, of the firm of Messrs. A. Ruffer & Sons, bankers, 39, Lombard Street, E.C., has joined the board of directors of the South Wales Electrical Power Distribution Co.

NEW COMPANIES REGISTERED.

Church Stretton Electric Supply Co., Ltd. (80,857).—This company was registered on May 4th, with a capital of £10,000 in £1 shares, to adopt an agreement with the Church Stretton Land Co., Ltd., and to carry on at Church Stretton, Salop, or elsewhere, the business of suppliers of electric light, constructors and fixers of cables, wires, lines, accumulators, lamps and works, generators, accumulators, distributors and suppliers of electricity, contractors for the lighting of streets, markets, buildings and other public or private places, electricians, mechanical engineers, &c. The first subscribers (each with one share) are:—Hon. G. E. Hill-Trevor, 14, Onslow Square, S.W.; G. H. Dorrell, Castle House, Horsell, Surrey, barrister; Hon. H. P. Mostyn, 23a, St. George's Road, W.C.; C. H. Culross, 1, Clement's Inn, W.C., clerk; H. Light, 126, Cleve Road, West Dulwich, S.E., clerk; H. Bourdillon, 15, Tavistock Place, W.C., accountant; and W. B. J. Wall, 18, Adam Street, W.C., secretary. No initial public issue. The first directors are the Hon. H. P. Mostyn, G. H. Dorrell, and the Hon. G. E. Hill-Trevor; qualification, £50; remuneration, 1 guinea each per board meeting attended (2 guineas for the chairman). Registered office, 19, Adam Street, Strand, W.C.

Oulton Broad Electricity Co., Ltd. (80,824).—This company was registered on April 30th, with a capital of £5,000 in £1 shares, to acquire the business of electric light and power suppliers, electric and general engineers, boat builders, &c., carried on by Messrs. Barber, Croft & Co., at Oulton Broad, Suffolk, to adopt an agreement with B. Barber, J. Croft, T. Horne, and H. Johnson, and to carry on the business of an electricity company in all its branches. The first subscribers are:—H. Johnson, Oulton Broad, Lowestoft, brick maker, 100 shares; R. S. Stranack, Oulton Broad, engineer, 100 shares; T. H. Horne, Oulton Broad, hotel proprietor, 100 shares; B. Barber, Oulton Broad, electrical engineer, 100 shares; J. Croft, Oulton Broad, engineer, 100 shares; E. H. Gostling, Surrey Street, Lowestoft, accountant, 5 shares; and S. C. Whittaker, Wherry Hotel, Oulton Broad, clerk, 10 shares. Minimum cash subscription, £600. The number of directors is not to be less than three nor more than five; the first are R. S. Stranack, H. Johnson, and B. Barber; qualification, £100; remuneration, £6 each per annum, and 10s. for each meeting above 12 attended.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Electric Traction Co., Ltd. (49,855).—A trust deed, dated April 21st, 1904, to secure £250,000 second debenture stock (with power to issue further stock, ranking *pari passu* up to half the subscribed capital for the time being) has been registered. Property charged: The company's undertaking and property, present and future. Trustees: Electrical and General Investment Co., Ltd., 1 and 2, Great Winchester Street, E.C.

Northern Counties Electricity Supply Co., Ltd. (67,924).—Issue, on April 14th, of £10,600 debentures, part of series created February 18th, 1904, to secure £100,000. Property charged: The company's undertaking and property, present and future, except uncalled or unpaid capital. Holders: T. E. Hodgkin and J. W. B. Pease, Collingwood Street, Newcastle-on-Tyne; and Admiral H. Cleveland, Bolton Crofts, Richmond, Yorks. No trustees. Previously issued of same series: £10,000.

Sunbeam Lamp Co., Ltd., Gateshead (25,498).—Issue, on April 28th, of £200 debentures, part of series created January 28th, 1904, to secure £10,000, charged on the company's undertaking and property, present and future, except uncalled and unpaid capital. No trustees. Previously issued of same series: £8,200.

Electric Light Insurance and Maintenance Co. (1904), Ltd. (80,801).—A debenture for £2,000, dated May 4th, 1904, charged on the company's real and personal property, present and future, except uncalled capital, has been registered. Holder: E. Hill, 79, Mark Lane, E.C.

Electric Wiring and Fittings Co., Ltd. (29,676).—This company's annual return, made up to January 28th, was filed on April 18th. 1,382 shares had been taken up out of a nominal capital of £5,000 in £1 shares. £1 per share has been called up, and £1,375 has been received. £7 remains in arrears. Mortgages and charges: Nil.

Fladbury Electric Light and Power Co., Ltd. (63,942).—This company's annual return, made up to December 31st, 1903, was filed on May 3rd, when 857 shares had been taken up out of a nominal capital of £2,000 in £1 shares. £855 has been received, and £2 remains in arrears. Mortgages and charges: Nil.

Improved Electric Glow Lamp Co., Ltd. (66,465).—An indenture dated April 21st, 1904 (supplemental to trust deed dated July 18th, 1901, securing £4,000) charged on the company's undertaking and property, present and future, including uncalled capital, has been registered. Trustees: H. Muff, The Red House, Bexley Heath; and F. L. Gardner, Basildon House, Moorgate Street, E.C.

Ledbetter & Co., Ltd., electricians, Leicester (76,188).—A debenture created 16th, and dated April 18th, 1904, to secure £350, charged on the company's property, present and future, including uncalled capital, has been registered. Holder: A. W. Rose, Glebe Road, Nuneaton.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd. (1,122 C).—Issue, on May 3rd, of £99,000 4½ per cent. second debentures, part of series created April 12th, 1904, to secure £100,000. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to £300,000 prior debentures. No trustees. No previous issue of same series.

Hove Electric Lighting Co., Ltd. (36,942).—This company's annual return was filed on April 12th, when 15,000 shares had been taken up out of a nominal capital of £100,000 in 20,000 shares of £5 each. £5 per share has been called up on 13,000, and £2 per share on 2,000 shares, resulting in the receipt of £70,247, including £1,263 paid in advance of calls. £16 remains in arrears. Mortgages and charges: £44,600.

Electrical Trades Supply, Ltd. (67,616).—This company's annual return was filed on April 7th, when 2,507 shares had been taken up out of a nominal capital of £5,000 in £1 shares. £2,507 has been received. No mortgages or charges.

Howard Conduit Co., Ltd. (69,470).—This company's annual return was filed on April 14th, when 1,007 ordinary and 1,000 deferred shares had been taken up out of a nominal capital of £20,000 in 19,000 ordinary and 1,000 deferred shares of £1 each. £7 has been paid, and £2,000 is considered as paid. No mortgages or charges.

Beck & Moss, Ltd. (80,298).—This company's annual return was filed on April 20th, when the entire capital of £2,500 in £1 shares had been taken up. £525 had been paid, and £1,975 was considered as paid. Mortgages and charges: £50.

Ernest F. Moy, Ltd. (47,408).—This company's annual return was filed on April 20th, when 7,873 ordinary and 1,420 preference shares had been taken up out of a nominal capital of £10,000 in 8,500 ordinary and 1,500 preference shares of £1 each. £9,193 has been paid, leaving £100 in arrears. Mortgages and charges: £1,300.

Metropolitan Electric Supply Co., Ltd. (25,395). — This company's annual return was filed on April 21st, when 100,000 ordinary and 75,250 preference shares had been taken up out of a nominal capital of £1,500,000 in 100,000 ordinary shares of £10 each, and 100,000 preference shares of £5 each. £10 per share has been called up on 97,968 ordinary and £5 per share on 75,250 preference shares, resulting in the receipt of £1,355,930. £20,320 is considered as paid on 2,032 ordinary sharer. Mortgages and charges: £470,000.

Anglo-American Telegraph Co., Ltd. (2,891 C).—This company's annual return was filed on March 14th, when the entire capital of £7,000,000, consisting of £718,580 consolidated ordinary stock, £3,140,710 preferred ordinary stock and £3,140,710 ordinary stock, had been taken up and paid for in full. Mortgages and charges: Nil.

W. T. Henley's Telegraph Works, Ltd. (13,795).—This company's annual return was filed on March 31st, when 34,000 ordinary and 40,000 preference shares had been taken up out of a nominal capital of £400,000 in 40,000 ordinary and 40,000 preference shares of £5 each. £5 per share has been called up on 29,000 ordinary and £5,000 preference and £3 per share on 5,000 ordinary and 5,000 preference shares, resulting in the receipt of £363,942 (query including payments in advance of calls). £124 remains in arrears. £30,000 is considered as paid on 6,000 ordinary shares. Mortgages and charges, £45,900.

Notting Hill Electric Lighting Co., Ltd. (25,921).—This company's annual return was filed on May 6th, when 10,852 ordinary, 2,998 "ordinary preference" and 550 founders' shares had been taken up out of a nominal capital of £200,000 in 16,542 ordinary, 2,998 "ordinary preference" and 550 founders' shares, all of £10 each. £10 per share has been called up, and £144,000 has been received. Mortgages and charges, £55,000. Ditto issued jointly by this company and the Kensington and Knightsbridge Electric Lighting Co., Ltd., £148,000.

ELECTRICITY SUPPLY ACCOUNTS.

An analysis of the accounts for the periods ending March, 1903, and December, 1902, of the electric supply undertakings, established in the County of London under the provisions of the Electric Lighting Acts, 1882, has been issued by the L.C.C. in pamphlet form.

Although somewhat out of date, the information it contains forms an interesting record. The authorities supplying at that date comprised 15 municipalities and 14 companies (also the L.C.C. for public lighting only), and these possessed statutory powers—there was also the N.W. London Electric Supply Co. operating in Hampstead with an overhead distribution network, and thus avoiding the necessity of possessing statutory powers.

The only parts of the county for which no statutory powers were possessed, were small portions of Westminster, Chelsea, Lincoln's and Staple Inns, and a small portion of Woolwich. Six local authorities operated dust destructors in connection with their electrical undertakings.

During the periods mentioned, the local authorities had 27,644 KW. of plant in operation, generated 21,814,306 units, and supplied 939,293 equivalent 8-C.P. lamps, including 2,939 public arc and 1,198 incandescent lamps. The corresponding figures for the companies were: 94,045 KW. plant, 74,554,163 units, 3,973,142 equivalent 8-C.P. lamps, 1,776 public arc and 51 public incandescent lamps.

On the average, the local authorities worked with a better load factor (16·05) than the companies (13·62). They also produced and sold energy at a cheaper rate.

The respective percentages of gross profits to net capital expenditures of the municipal authorities and companies were 5·59 and 7·31; out of these surpluses the former paid interest equivalent to 3·28 per cent., and sinking fund equivalent to 1·47 per cent. of the capital expenditure. Depreciation was also recognised to the extent of ·1 per cent. on capital expenditure, £15,390 was carried to reserve, and £4,544 written off other items.

The companies paid out in interest and dividends the equivalent of 5·99 per cent. of their net capital expenditure. Out of the surplus then remaining, depreciation benefited to the extent of 1·44 per cent., £11,350 was carried to reserve, and £16,412 written off other items. The total capital expenditure of all the undertakings amounted to £14,159,704; and for the purpose of assessments the gross value of all the undertakings was £379,265, and the rateable value £250,323.

The Charing Cross and Strand Electrical Supply Corporation, Ltd.

The most interesting feature in the Charing Cross Co.'s 1903 returns appears to be the phenomenal growth of the City undertaking, which has obtained an output exceeding that of the West-end undertaking, after a brief three years' existence. The City undertaking has added some 90,000 lamps, and earned a revenue over 100 per cent. in excess of last year's amount.

The West-end undertaking shows a diminished output and revenue; nearly £8,000 worth of energy was purchased from the City concern, as against over £8,000 worth supplied to the latter last year. The working expenses are, in the case of the West-end, slightly higher, and the City, under the improved conditions, greatly reduced, in comparison with last year.

The prices charged are:—5d. to 2d. per unit, private lighting, and 3½d. to 1d. per unit for power purposes. Mr. W. H. Patchell is the chief engineer.

General Statement.

For year ending Dec. 31st.	1903.		1902.	
	W. End.	City.	W. End.	City.
Total capital expended	£923,814	£960,800	£767,562	£591,101
Number of units sold—				
Private supply ...	7,099,687	5,033,880	7,967,849	1,987,640
Public lighting ...	293,104	—	282,101	—
Total units sold ...	7,392,791	5,033,880	8,249,950	1,987,640
Equivalent number of 8-C.P. lamps connected	335,031	242,113	280,606	150,729
No. of public lamps ...	113	—	113	—
Maximum load in KW....	4,284	5,713	3,941	3,335
Revenue account—				
Gross revenue ...	£113,294	£57,719	£119,019	£28,537
„ expenditure ...	£64,182	£36,018	£67,884	£23,863
„ profit	£49,112	£21,701	£51,135	£4,674
Average inclusive price obtained—				
Private lighting ...	3·68d.	2·75d.	3·46d.	3·45d.
Public lighting ...		—		—

Revenue Account for Year ending Dec. 31st, 1903.

—	West-end.		City.	
	Gross.	Per unit.	Gross.	Per unit.
Gross revenue	£113,294	3·68d.	£57,719	2·75d.
Works and distribution costs (inc. pub. ltg.)...	£49,679	1·61d.	£24,404	1·16d.
Total working costs ...	£64,182	2·08d.	£36,018	1·74d.

Profit Statement (West-end Undertaking).

Interest on loans and debentures	£19,333
Dividends, &c...	43,750
To depreciation	10,000
Balance carried forward	10,140
Interest on "City" investments brought forward	−14,250
Last year's balance brought forward	−19,861
Gross profit	£49,112

As a result of the year's work the West-end undertaking earned a surplus of £49,112, which, with interest on investments and amounts brought forward, was distributed as shown, the depreciation fund benefiting by £10,000, bringing it up to a total of £65,000, and a balance of £10,000 being carried forward to the next account.

The City concern earned a gross profit of £21,701, which, with interest, &c., amounts to £29,000, and was allocated as shown overleaf. The balance of £11,499, supplemented by £5,000 guaranteed by the West-end undertaking, was utilised for financial charges, leaving a deficit of £780 to be carried forward.

PROFIT STATEMENT (CITY UNDERTAKING).

Debit balance last account	£271
Interest on debentures, &c.	17,270
Balance carried down	11,499
Interest accumulated	—7,339
Gross profit	£21,701

Canterbury Corporation Electricity Supply.

We give herewith the returns of the Canterbury Electricity Department for the year ending March 31st last, the fifth year of working. The output and revenue show a very satisfactory increase over last year's figures, and as this has been achieved with but an insignificant increase in the working expenditure, the gross profit has benefited correspondingly, and a substantial balance is carried forward.

The prices charged are: — Private lighting, flat rate 5d., or maximum demand 7d. and 2d. per unit; power, 3d., with discounts up to 50 per cent.; public arcs, £25 per annum; incandescents, £3 10s. per annum. The chief engineer is Mr. C. A. Blascheck.

GENERAL STATEMENT.

For year ending March 31st—	1904.	1903.
Total capital expended	£54,028	£52,248
Number of units sold—		
Private supply	238,445	200,347
Public lighting	163,133	144,939
Total number of units sold ...	401,578	345,286
Equivalent No. of 8-C.P. lamps connected	21,995	19,198
Number and H.P. of motors connected ...	31 = 66 B.H.P.	23 = 41 H.P.
Number of public lamps	12 arcs, 440 incan. 19 Nernst	12 arcs, 415 incan. —
Maximum load in KW.	339	293
Revenue account—		
Gross revenue	£7,016	£6,089
„ expenditure	£3,086	£3,143
„ profit	£3,930	£2,946
Average inclusive price obtained per unit—		
Private lighting	4·96d.	5·00d.
Public lighting	2·74d.	2·80d.

REVENUE ACCOUNT FOR YEAR ENDING MARCH 31ST, 1904.

Gross revenue	£7,016 = 4·19d. per unit.
Works and distribution costs (including public lighting)	£2,143 = 1·28d. „
Total working costs	£3,086 = 1·84d. „

PROFIT STATEMENT.

Interest on loans, &c.	£1,484
Sinking fund	1,753
Interest on stock and balance brought forward ...	—125
Balance on year's working	819
Gross profit ...	£3,930

CITY NOTES.

Edison and Swan United Electric Light Co.

MR. H. WOLFENDEN presided at Winchester House, Old Broad Street, E.C, on May 12th, over an extraordinary general meeting of this company. He proposed:—

That the capital of the company be reduced from £1,000,000 divided into 150,000 "A," and 50,000 "B" shares of £5 each, to £941,090 divided into 150,000 "A" shares of £5 each, 26,436 "B" shares of £5 each, and 23,564 "B" shares of £2 10s. each, and that such reduction be effected by cancelling paid-up capital which has been lost, or is unrepresented by available assets to the extent of £2 10s. per share on each of the 23,564 "B" shares which have been issued, and are now outstanding, and by reducing the nominal amount of each of such 23,564 "B" shares to £2 10s.

He assumed all the shareholders were perfectly familiar with the objects of the meeting. The balance-sheet to June 30th, 1903, showed on the asset side of the balance-sheet, "Balances of special charges, £58,472 16s. 11d." and "Balance of net revenue for 1901 and 1902, £4,026 17s. 2d."—a total of £62,499 14s. 7d. This sum was capital which had been lost in the past, and was not represented by available assets, and, that being the case, it must be provided for by writing down the capital or out of profits. They gathered that it was the wish of the shareholders generally to deal with it by writing down, and they were advised that, by the agreement in Clauses 3 and 5 of the articles of association, any reduction fell first on the "B" shares, which were deferred both as to dividend and capital. About £9,000 was the balance of loss incurred by closing the factories and depôts, and £44,000 was the loss revealed by the re-valuation of stocks which existed in 1901, and which re-valuation had since been proved not to have been too low. £4,000 represented debts owing by the company, and not brought into account, and bad and doubtful debts owing to the company, for which no provision was made in the balance-sheet of 1901. To sum up, £58,472 16s. 1d. was lost prior to the present board being formed in 1901, while £4,000 odd was due to losses since. They proposed to reduce the "B" shares capital by £2 10s. per share, making £58,910, leaving £3,589 14s. 7d. to be provided out of current earnings. He took it that exception would be taken to the scheme on account of its being excessive. The cost of establishing the business and goodwill stood in the balance-sheet at £443,451, but it did not seem to the directors that this required dealing with at the present moment. Its presence in the balance-sheet did not affect the earnings of the business. If they dealt with it by a reduction of capital it would mean the total extinction of the "B" shares. They therefore thought it better to leave this for future consideration, when it could be dealt with either by again reducing the share capital or by creating a reserve fund. The business generally was progressing satisfactorily, and they hoped to show a marked improvement in the results during the current financial year ending June 30th next.

MR. ELLICE-CLARK seconded, and after some complimentary remarks from Mr. LEA SMITH, the resolution was carried.

Castner-Kellner Alkali Co.

SIR WM. MATHER presided on Monday at the annual meeting, held at Cannon Street Hotel. The year had not shown any marked features, owing to the condition of the alkali trade, the price for the products having remained abnormally low, and their chief product had suffered very much in consequence, affecting generally the results of their business. Negotiations had been carried on over a long period by the chief alkali manufacturers of Great Britain and America to revive the agreement which elapsed some two years ago, affecting the price of their alkali products. About the middle of last year arrangements were come to among the chief competing houses, and consequently a slight improvement would be felt this year, though the parties to the arrangement had been compelled to make their contracts with their consumers for a year ahead, more or less, just previous to the time when the agreement was entered into, at the low prices prevailing. It was hoped that the arrangement would continue, as it was to the interests of all parties in the alkali trade to maintain the agreement for the improved prices, as consumers would be in no wise injuriously affected, because, even when the improvement took place, the price of alkali products would be even then at a less cost to the consumer than they had been for many years previously. He mentioned last year that they had undertaken a scheme for converting their coal fuel into power-gas, from which they expected to derive great economy in power. The development and perfecting of the scheme had taken very much longer than they could reasonably anticipate a year ago. The contractors had only recently delivered the plant. The directors were, however, satisfied that the undertaking would repay the cost, judging by their recent experience. They had applied the power-gas to firing their boilers instead of coal; they had also applied portion of the gas to a large gas engine of 800 H.P., and they were in a position to say that the change from the steam engine to the gas engine would show very considerable economy in cost. The second engine of the same size was now being erected. The outlay for this large expenditure had been obtained by using the depreciation reserve fund. Last year he said that he was sanguine about the further development of schemes for enabling the company to use its alkali products to greater advantage than was at present possible. He was glad to say that they had completed arrangements which would soon enable them to prove the value of the development. Being new, they had to be proved, but he had given a great deal of personal attention to the matter, and he was sanguine of the results. Under the circumstances, considering the unexpected and long-continued ordeal through which they had passed, their dividend of 4 per cent. for the year was satisfactory.

SIR HENRY ROSCOE seconded the adoption of the report, and it was carried unanimously.

The Great Northern Telegraph Co. (of Copenhagen).

THE general meeting of this company was held at Copenhagen on April 30th, Commodore E. Suenson, D.R.N., presiding.

In the course of his speech the CHAIRMAN said that as to the interruptions of cables during 1903, there were 10 of them in Europe interrupted 15 times, and six in the Far East 11 times. In Europe the cable steamer *H. C. Orsted* (replaced in December by the *Pacific*) was on active service for 80 days, and the cable steamer in the Far East, the *Store Nordiske*, for 208 days, of which 74 were for the account of other administrations. The company's second cable steamer for service in the Far East, the *Pacific*, was completed in the month of November, and made her trial trip completely satisfactorily. She has twin screws and powerful engines, a speed of more than 12 knots, and is able to effect cable repairs in depths up to 3 to 4,000 fathoms. As the Eastern Extension Telegraph Co. also employ this company's steamers, for the maintenance of their cables in China, the directors have agreed with that company to keep the *Store Nordiske* and the *Pacific* for joint account, which, of course, will reduce this company's expenses in connection with the ships. The *Pacific* was retained in Europe during the first months of the present year, in order to replace the *H. C. Orsted* whilst the latter was undergoing a complete overhauling. The *Pacific*, therefore, left Copenhagen on April 9th for London, where she will fill up her tanks with spare cable for this company's depôt at Woosung. After referring to the question of tariff reductions consequent upon the International Telegraph Conference, and the laying of the new American cable between San Francisco and the Philippine Islands, thereby establishing a competing route, the chairman turned to the position in the Far East. Toward the end of the year there was an

increase of traffic, both Government and Press, consequent upon the complications, but, he continued:—

"Now that war between Russia and Japan has broken out, it would, however, be a mistake to rely too much upon a continuance of this increase of the traffic, whilst, on the other hand, the danger to which our cables and telegraph lines are exposed is only too evident. Our two cables between Wladiwostock and Nagasaki, which form a direct connection between the territories of the two belligerents, were closed already on February 9th, and, although we have been able from February 23rd to substitute the route *vid* Peking-Kiachta-Irkutsk for the one *vid* Wladiwostock, the security of the new route will depend upon the chances of war. Passing through Mongolia, it is, fortunately, as yet very far from the theatre of war, but may be exposed to other dangers. Three of our cables in the Far East connect Japan with China and Korea; one of them (between Tsushima and Fusan) has always been worked by the Japanese Administration, whilst the other two (between Nagasaki and Shanghai) are in our hands and are still intact. All these cables are unfortunately exposed to the risks of war."

Some remarks respecting renewals of concessions, and the general financial result of the year with an increase of the dividend from 12½ per cent. to 15 per cent. were followed by the adoption of the report by the meeting.

Western Telegraph Co.

Sir J. Wolfe Barry presided on Tuesday at the half-yearly meeting, held at River Plate House, and in moving the adoption of the report, he said that the message receipts were £202,062, against £212,682—a decrease of £10,621 as compared with the corresponding period of 1902. A large part of the decrease was due to the fact that, in the 1902 period, they carried the whole of the traffic with Brazil and an increased portion of traffic with West Africa, in consequence of the interruption of the competitive route. The traffic with the River Plate and West Coast of South America showed a substantial increase. The interest on investments on account of reserve was now carried to revenue account, instead of, as heretofore, to the general reserve fund, thus following the example of the Eastern and Eastern Extension Cos. In regard to the current half-year, though the March quarter showed a decrease of traffic compared with last year, that decrease was now being reduced by the improved returns of the last six weeks, and he hoped that they would possibly disappear altogether before June 30th. There was a small decrease in the general expenses in London, but an increase of nearly £6,400 in the expenditure abroad, distributed over 11 items. This extra expenditure was largely due to fever epidemics which had occurred at some of the stations, and which made themselves felt in the items of salaries, travelling expenses, medical expenses, &c.; the increased expenditure was also due to new furniture necessitated for the large quarter at Rio, and to maintenance of land lines, electrical instruments, &c. The bulk of these items were of a more or less non-recurrent nature. Six items in the accounts showed decreases. Repairs to cables and ships cost £9,531 more than last year. The *Norseman* cost more in coal, stores, and repairs, as she had to be at sea for a considerably longer period. The new ship, the *Cormorant*, had cost £2,900, and this ship had fully justified her acquisition. There was a saving of £1,200 through not having to charter any steamers this half year. The net increase in expenses not coming under abstracts A and B, was £7,944. The net result was a decrease in revenue, excluding interest on reserve investments of £10,600, and an increase of close upon £14,300 in expenses. After providing for £13,578 for debenture interest and sinking fund, and £2,622 for income-tax, there was, including the balance £2,639, £115,318 available. The first and second interim dividends, amounting to £62,000, had been paid, £30,000 was transferred to general reserve fund, and £18,000 to maintenance of ships' reserve fund, leaving £4,939 to carry forward. The large sum of £18,000 was to be carried to the ships' reserve fund, because the *Norseman* had proved herself incapable of repairing a fault which had occurred at 1,600 fathoms depths on the Para-Pernambuco cable, which was interrupted through a seismic disturbance. The board had decided to replace the *Norseman* by a larger and more powerful steamer, and as time was of importance, they had agreed to purchase the Eastern Co.'s *Mirror*, which had proved herself capable of repairing cable at any depths. There would, of course, be a loss owing to the disposal of the *Norseman*, and that was why they had placed this large sum to the ships' depreciation account.

Sir J. D. Pender seconded the motion, and it was adopted.

Globe Telegraph and Trust Co.

The Marquess of Tweeddale presided at the meeting held at River Plate House, E.C., on Tuesday. He said that the report dealt with the first complete year since the change was made in the time of holding the annual meeting, and as the period which ended April 30th was a broken one, covering about nine months, they could not compare figures for this year and last, but the company was never in a better position than now, the dividend on the ordinary shares (5½ per cent.) being the largest paid since the commencement of the company. During the year they had continued to watch closely the various companies in which they held investments, and had made changes contributing to the prosperous condition of the company. The chairman then referred *seriatim* to the various sales and purchases of securities which had been effected during the year in Commercial Cable Co., the West African, the Great Northern Co., the Western Telegraph, and the American Telegraph Cable Co., and the improved rates of interest earned thereon as a result of the changes. The capital of the Trust Co. was well invested, and the companies in which they had the largest interest were paying good dividends. Last year the *depreciation* of their securities was £273,381; but this year the *appreciation* had been £43,259, so that there had been an increase of £316,640 in their value. From that fact it might be fairly inferred that the public confidence in submarine cable securities, which was somewhat shaken by the prospect of serious competition from wireless telegraphy, was now returning.

Sir J. D. Pender seconded the motion, which, after some discussion, was carried.

The retiring director and auditors having been re-elected, the meeting came to a close with the customary vote of thanks.

Rand Central Electric Works.

The report for 1903, to be presented at the meeting on the 31st inst., states that the revenue derived from the supply of power during the year under review has been augmented by £18,043, and the result of the year's operation shows a working profit of £28,500 before deduction of the sum set aside for depreciation. During the first four months of this year there has been an increase of revenue of about £8,200, as compared with the same period of last year. Receipts derived from the supply of power and rent of plant during 1903 totalled £70,513, as compared with £52,469 19s. 7d. during 1902. The accounts show a gross profit of £28,547, and, after deducting £17,962 set aside for depreciation, there remains a net profit of £10,584, which, with the balance of reserve account now transferred, reduces the deficit brought forward from last year to £11,948. The general manager's report shows that the total power generated during the year was 8,192,680 KW.-hours, while the demand was of a more uniform character. The directors have been unsuccessful in their efforts to obtain from the Imperial Government a refund of the amount of £2,730 appearing in last year's balance-sheet as a claim against them. This sum has, therefore, been written off against "reserve account," the balance of which, as previously mentioned, has been appropriated towards the reduction of the debit balance. The question of the extension of the works has engaged the attention of the directors, and it has been decided to increase the capacity of the plant by 1,000 KW. As a first instalment, an order has been placed for a steam turbine of 400 KW., and if this type of machinery proves successful, the full extension will be proceeded with on similar lines. Mr. A. Brakhan, who resigned his position as chairman of the local board on account of his prolonged absence from South Africa, has returned to Johannesburg, and, at the request of the directors, has resumed his seat on the local board. Mr. M. Francke, who was appointed to succeed Mr. Brakhan, has retired.

West India and Panama Telegraph Co.

The fifty-fourth ordinary general meeting of this company was held on Wednesday at Winchester House, E.C., Mr. W. B. Kingsford being in the chair.

In moving the adoption of the report and accounts, the Chairman said that the amount to credit of revenue was £32,399, against £31,062 in the corresponding half-year of 1902. They would see from the report that the revenue account had been credited with the sum of £1,485, which was a small surplus after adjusting the *Grappler* accounts consequent on its loss. There was another item of £1,500, which had accumulated for a number of years in respect of the adjustment of income-tax; as it was no longer required it was considered that the time had arrived for its transference to revenue. Without making those transfers, the dividend of 6s. could not have been paid. It was the directors' desire to prevent arrears increasing. There had been an increase in the expenses of repairing cables during the half-year, which was partly due to repairs to land cables in Jamaica, which were destroyed by the hurricane of last August. No less than 44 knots of cable had been used in ordinary repairs, against 19 knots used during the corresponding period of last year. A sum of £934 had been charged to reserve in respect of 11 knots of cable expended in the partial renewal of the service between St. Lucia and St. Vincent, which was interrupted by the volcanic eruptions at St. Vincent. The expenses of the ss. *Henry Holmes* compared favourably with those of the *Grappler*, although no doubt some of the expenses connected with that vessel would be somewhat heavier, as there were structural and mechanical differences between the two vessels. It was the policy of the captain, however, to keep down expenses so far as was consistent with efficiency. After much difficulty the repair of the St. Lucia—St. Vincent cable had been completed after having been twice interrupted, and after that work the *Henry Holmes* spent some weeks on the Dominica—Martinique and the Martinique—St. Lucia cable. It was while engaged on the first-named on May 3rd, 1902, near St. Pierre, that the ss. *Grappler* was destroyed by the eruption. With the loss of one ship, it was considered that it would be a risky thing to continue under such dangerous conditions, as Mount Pelée was then still smoking, so operations were suspended until a safer and more peaceful time. When they took the work in hand, it would mean a deviation of route. In conclusion, he said that it could not be considered satisfactory that the dividend of 6s. should be derived from previous accumulations, but still he hoped that some day the valuable service which the company had rendered to the Imperial Government, and to the Governments and commercial interests of the West Indies, would be rewarded by better traffic and substantial assistance from the Governments of the Colonies. Their difficulties, as they knew, were owing to the poorness of traffic and the volcanic nature of the seabed upon which their cables had to be laid, which led

to great expense for their maintenance and renewal. For some years past their difficulties had been increased by competition on three parts of their system, and now they were threatened with a future competition by a cable into the very heart of their system. He doubted, however, whether any company would be willing or able to keep up such a system as theirs, with its 4,000 miles of cable and its 21 stations, several of them quite unremunerative. As it was, one company found it barely possible to live. The capital of their company was £1,275,000, and it was held by over 1,800 shareholders, and he was strongly of opinion that, to say nothing of the question of fairness and common justice to themselves, it would be contrary to public policy that the Imperial public should do anything, either directly or indirectly, which would seriously endanger their important undertaking. He was happy to say that, in that opinion, he was supported by no less weighty an authority than the Inter-Departmental Committee on the Cable Communication of the Empire, of which Lord Balfour of Burleigh was the chairman. In the blue book which contained their report, occurred the following passage, which he would read to the meeting: "It is of paramount importance to the country so to direct its telegraph policy that the network of British-owned cables shall continue to be remunerative to those whose enterprise has created it." That was the express and deliberate opinion of the Committee. Their system in itself formed a great network of British-owned submarine cables, but, unfortunately, it had never been really remunerative. In any case, he hoped that the Government might remember what the Committee had stated as their emphatic opinion.

The motion was seconded by Mr. HENRY HOLMES, and carried.

Mr. Henry Holmes having being re-elected a director on the motion of the CHAIRMAN, seconded by Mr. DANIEL LE ROUGETET, the auditors were re-elected, and the proceedings terminated.

Prospectus.—The list closed on Wednesday in an offer of 120,000 ordinary shares of £5 each of the Anglo-Argentine Tramways Co. at £5 10s. each. The shares are offered by the River Plate Trust, Loan, and Agency Co. on behalf of the syndicate to whom they were issued with other shares as payment for the conversion of the company's system in Buenos Ayres from horse to electric traction. The remarkable results which have followed the electrification of the system, together with the arrangements which were made with the company who undertook the conversion have already been stated in our columns (see "City Notes," April 1st and 15th).

Newcastle-upon-Tyne Electric Supply Co.—This company recently offered for subscription an issue of 17,991 preference shares of £5 each at a premium of 10s. per share, and 17,991 ordinary shares of £5 each at a premium of £1 per share, to shareholders or their nominees. We understand that the ordinary shares were over-applied for to the extent of 65 per cent.

Stock Exchange Notices.—The Committee has been asked to appoint a special settling day in and to grant a quotation to:—British Electric Traction Co., Ltd.—£250,000 4½ per cent. second debenture stock; and to allow the following securities to be quoted in the Official List—Potteries Electric Traction Co., Ltd.—further issue of 2,500 5 per cent. cumulative preference shares of £10 each, fully paid, Nos. 42,601 to 44,500 and 2,500 ordinary shares of £10 each, fully paid, Nos. 52,001 to 54,500.

Western Telegraph Co.—The directors have declared an interim dividend of 3s. per share (at the rate of 6 per cent. per annum), free of income-tax, for the quarter ended March 31st, 1904.

Loch Leven Water and Electric Power Co.—A meeting of this company was held at Edinburgh on 16th inst., Mr. John D. Bonner presiding. The meeting approved of the draft provisional orders for which application was made to the Secretary for Scotland last month—the one to confer further powers on the company, and to extend the time for the purchase of lands, and for the completion of part of the authorised works of the company, the other to extend the time limited by the "Loch Leven Water-Power Act, 1901," for the construction of the waterworks electrical generating stations, and other works.

Indo-European Telegraph Co.—At an extraordinary meeting held on Monday, a resolution was passed effecting certain alterations in the articles enabling the allocation of moneys for the establishment of a pension fund.

STOCKS AND SHARES.

Wednesday Evening.

INVESTORS continue to monopolise the greater part of Stock Exchange attention, and again it has to be recorded that speculation plays second fiddle to business of more solid description. Plenty of money, and rumours of a further fall in the Bank Rate are factors distinctly favourable to rising prices. This week the Electricity Supply market has commenced to attract more consideration than it has done for some months past. Dealers engaged here are much more active, and the market all round is pretty strong, the rise being general, although with no outstanding feature of sensation. Telegraph stocks still continue in the ascendant, while Miscellaneous descriptions are a trifle neglected.

County of London Ordinary, and Metropolitan Ordinary are both 10s. better, at 8 and 20 respectively. The rise in the former is due to the good return for the past quarter, the figures showing an improvement of nearly £6,000 as compared with the corresponding period in 1903. We gave the details last week. Metropolitan Preference are ⅛ up at 5½, and the Marylebone Council's Bill has passed its first stage. South Londons have recovered the 5s. they dropped recently, and a rise of a like fraction has made City Ordinary 11 middle, the improvement being 10s. in a fortnight. Edmundson's Preference are firmer at 5⅞, an advance of ⅛, but the Urbans shares show no change, and the company's new Debenture stock is quoted at 1 discount to par. Another jump of 3 points has left Blackheath and Greenwich Debenture at 121½, the rise in the stock, due to the conversion scheme we mentioned a fortnight back, having been remarkably rapid, and there is still practically none to be obtained. The shares do not move, but, perhaps their turn may be near at hand.

Several interesting new issues have lately appeared, and others are about to appeal to the public very shortly. We have this week seen draft prospectuses of the British Columbia Telephone Co. and of the Sunderland District Electric Tramways Co., but in neither case were the full particulars settled, although, of course, they may be by this time. The British Columbia Telephone Co. will offer Debentures, and the Sunderland District issue may possibly take the shape of shares and Debenture stock as well. Underwriting is being done in both instances. The new Anglo-Argentine Tramways Ordinary shares look a sound investment, and as the company is excellently managed, it will probably maintain its reputation for steady progress. The Preference have hardened to 5⅛, and the fresh capital will, of course, make their position all the more secure. At 5¼ the yield on these shares is 4¾ per cent., and considering the character of the security, this is a good return, auguring a possible rise in the price. City of Buenos Ayres Tramway shares keep at 9⅛, and the 6 per cent. Debenture stock is 132½. London United Preference are dullish at 11¼; shares changed hands at 11⅛ the other day. This is no doubt because the company is offering 25,000 more Preference shares to its shareholders at 10 guineas per share. British Electric Tractions shares have not moved, but the Debenture stock is a point firmer at 117¼.

In the telegraph market, Indo-European shares are £2 better upon a very slender demand in a limited market, and Eastern Telegraph Ordinary is 2 points up at 129½. Both reflect the increasing demand for good investments from which a good rate of interest is obtainable. Eastern Extensions at 12 are nominally ¼ easier, but the dividend of 6s. 6d. is deducted, so that on balance there is really a little rise, notwithstanding the somewhat chastened speech of Sir J. Wolfe Barry at the company's meeting a fortnight ago, West India and Panama Preferences have each added ¼, partly on the idea that the settlement of Panama under United States suzerainty will probably stimulate business in all directions Anglo-American Telegraph stocks are merely quiescent, the Yankee market having fallen upon the quietest times known for several years past; Cuba Telegraphs are both *ex* dividend, and may receive attention now that the island is doing much better in the way of trade, and that a Government loan is on the point of emission.

Globe Telegraph Ordinary fail to recover their drop to 9¼, but the Preference have gone ahead to 13¼. Telegraph Constructions, too, are a £ better at 36½. Of the National Telephone stocks, the Deferred has lost ground at 88½, while the 4 per cent. Debenture at 104 is better, and the new stock has been done at 5⅜ pm., although it has slipped back to 5¼ pm. At 105 the Preferred is a point to the good.

Of the Electrical Railway stocks, Central London Ordinary is down 1 per cent. to 93, the cause of the decline being mainly connected with fears of District competition when the latter line is electrified. Districts are now 41, and Metropolitan 96½, the dramatic rise of the previous week bringing in a few sellers. Great Northern and City Preferred "A" shares at 5½, and Great Northern, Piccadilly and Brompton Ordinary at 9½, exhibit no alteration. East Londons are 5, and Mersey Consolidated 7½.

One or two of the Industrial shares have varied slightly, British Westinghouse Preference moving down to 3⅜, and Electric Constructions to 2¼. On the other hand, British Aluminium Preference are ¼ up at 5, and the "A" Preference are 8½. Brush Preference recovered their deducted dividend of about half-a-crown, and some speculative buying of Edison & Swan on the reduction of the company's capital has raised the price of the shares to 5s. per share.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1901.	1902.	1903.	Closing Quotations May 11th.	Closing Quotations May 18th.	Business done week ended May 18th, 1904. Highest	Lowest
67,100	African Direct Telegraph, 4 % Debs.	100	..	..	..	98 —102	* 99 —103	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	..	..	..	2⅛ — 8½	2⅛ — 8½	..	..
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	..	..	..	70 — 80	.. — ..	..	..
788,840	Anglo-American Telegraph	Stock	61s.	60/6	61s.	49 — 52	49 — 52	50	..
3,105,580	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	94 — 96	94 — 96	95⅛	94½
3,105,580	Do. do. do. Deferred	Stock	2s.	1/-	2s.	7⅛ — 7⅜	7⅛ — 7⅜	7¼	..
44,000	Chili Telephone, Nos. 1 to 44,000	5	5 %	6 %	..	4½ — 5½	4½ — 5½	..	..
18,333,300$	Commercial Cable	$100	8 %	8 %	..	175 —185	175 —185	..	..
1,841,209	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	..	..	..	93 — 95	94 — 96	96	95½
16,000	Cuba Telegraph	10	4 %	6½ %	5 %	7⅛ — 8⅛	7 — 8 xd	..	..
6,000	Do. 10 % Pref.	10	..	..	..	15½ — 16½	15 — 16 xd	..	..
12,931	Direct Spanish Telegraph	..	..	..	..	.. — ..	.. — ..	..	..
6,000	Do. do. 10 % Cum. Pref.	5	..	..	..	7 — 8	7 — 8	..	..
30,000	Do. do. 4½ % Debs.	50	..	..	..	99 —102	99 —102	..	..
60,710£	Direct United States Cable	20	8½%	8½%	..	10 — 10½	10 — 10½	10½	10½
85,800	Direct West India Cable, 4½% Reg. Deb., within Nos. 1 to 1,300, Red.	100	..	..	..	98 —101	99 —102	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	..	125 —130	127 —132	130½	128
1,955,555	Do. 8½ % Pref. Stock	100	..	..	..	86 — 89	86 — 89	88½	86
1,534,645	Do. 4 % Mort. Deb. Stock Red.	Stock	..	..	..	104 —107	104 —107	105½	104½
800,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	7 %	12 — 12½	11⅞ — 12⅛	12⅛	11⅛
320,000£	Do. 4 % Deb. Stock	Stock	..	..	..	104 —107	104 —107	..	..
800,000	Eastern & South African Tele., 4% Mt. Db., Nos. 1 to 8,000, red. 1909	100	..	..	..	99 —102	99 —102	..	..
200,000£	Do. do. 4 % Reg. Mort. Debs. (Mauritius Sub.) 1 to 8,000	25	..	..	..	99 —102	99 —102	100½	..
180,227	Globe Telegraph and Trust	10	5½%	£3 16 7*	5½%	9 — 9½	9 — 9½	9⅜	..
180,042	Do. do. 6 % Pref.	10	..	..	..	12½ — 13½	13 — 13¼	13⅜	13½
150,000	Great Northern Telegraph, of Copenhagen	10	15 %	12½%	15 %	25 — 26	25 — 26	..	..
58,700	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	..	..	..	98 —101	99 —102	..	..
17,000	Indo-European Telegraph	25	10 %	10%	10 %	40 — 43	42 — 45	44½	44½
1,988,333	National Telephone, Pref. Stock	100	5 %	6 %	6 %	103 —105	104 —106	105	103¾
1,966,667	Do. do. Def. Stock	100	..	4½%	5 %	88 — 91	87 — 90	89	87
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	11 — 13	11 — 13	..	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	11 — 13	11 — 13	11⅜	..
2,250,000	Do. do. 5 % Non-cum. 3rd. Pref., 1 to 250,000	5	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	5 5/32	5 3/32
000,000£	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	97 — 99	98 — 100	98½	97½
689,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	102 —104	103 —105	104	104
1,000,000	Do. do. Prov. Certs., 70 % to be paid	..	..	..	..	28 — 30	29 — 31	30½	29¾
179,313	Oriental Telephone and Elec. Nos. 1 to 171,604, fully paid	1	6 %	%	6¼%	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..
50,000	Do. do. do. 6 % Cum. Pref.	1	..	6..	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	..	..	..	97 —100	97 —100	..	..
11,889	Reuter's	8	5 %	..	..	6½ — 7½	6½ — 7½	..	..
3,808	Submarine Cables Trust	Cert.	..	..	..	117 —122	117 —122	120½	..
58,000	United River Plate Telephone	5	7 %	%	..	5½ — 6	5½ — 6	..	..
40,000	Do. do. 5 % Cum. Pref., Nos. 1 to 40,000	5	..	7..	..	4½ — 5½	4½ — 5½	..	..
179,947£	Do. do. 5 % Debs.	Stock	..	..	..	103 —106	103 —106	..	..
15,609	West African Telegraph, Shares	10	..	%	..	5 — 6	5 — 6	..	..
150,000£	West Coast of America, 4% Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	..	2..	..	97 — 100	97 —100	..	..
267,930	Western Telegraph, Ltd., Nos. 1 to 207,930	10	7 %	%	7 %	12½ — 13	12½ — 13	12⅝	12⅝
75,000£	Do. do. 5 % Debs. 2nd series, 1906	100	..	7..	..	101 —104	101 —104	..	..
400,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	100 —103	100 —103	..	..
88,321	West India and Panama Telegraph	10	..	..	..	⅜ — ½	⅜ — ½	..	..
34,563	Do. do. do. 6 % Cum. 1st Pref.	10	..	..	..	5½ — 6½	5 — 6	6⅛	6¼
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	..	..	..	4½ — 5½	5 — 6	..	..
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	..	..	..	100 —103	100 —103	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

20,000	British Aluminium 7 % Cum. Pref.	10	..	..	..	4¼ — 5	4½ — 5½	..	..
800,000£	Do. do. 5% 1st Mort. Deb. Stock Red.	Stock	..	..	..	87 — 93	90 — 95	..	..
100,000	British Electric Traction	10	9 %	8 %	..	9 — 9½	9 — 9½	9½	9¼
100,000	Do. do. 6 % Cum. Pref.	10	..	..	..	10 — 10½	10 — 10½	10⅝	10 5/16
600,000£	Do. do. 5 % Perpetual Debenture Stock	Stock	..	..	..	115 —118	116 —119 *	118½	116½
100,000	British Insulated and Helsby Cables	5	10 %	10 %	8 %	5¼ — 5⅜	5¼ — 5⅜	..	..
100,000	Do. do. 6 % Cum. Pref.	5	..	..	..	5¼ — 5⅜	5¼ — 5⅜	..	..
50,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	..	..	..	102 —105	102 —105	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	..	..	⅞ — 1	⅞ — 1	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	6 %	..	..	14/6 to 15/6	14/6 to 15/6	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	Nil	Nil	½ — 1	½ — 1	..	..
150,000	Do. do. Non-cum. 6 % Pref.	2	3 %	6 %	6 %	1 — 1⅛	1 — 1⅛ xd	1¼	1⅛
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	..	..	..	96 — 99	96 — 99	..	..
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	..	..	..	73 — 78	73 — 78	..	..
85,000	Callender's Cable Construction shares	5	20 %	15 %	12½%	10½ — 11½	10½ — 11½	..	..
40,000	Do. do. do. 5 % Cum. Pref.	5	..	..	..	5½ — 5⅝	5½ — 5⅝	..	..
90,000£	Do. do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	..	..	..	104 —108	104 —108	..	..
1,860,014	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	92 — 95	92 — 95	93¼	92½
494,998	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	98 —101	98 —101	..	..
494,998	Do. do. Def. do.	Stock	4 %	4 %	4 %	85 — 88	85 — 88	..	..
1,330,000	City and South London Railway	Stock	2 %	3½%	2¾%	50 — 52	49 — 51	51	..
85,000	Crompton & Co., Nos. 1 to 85,000	5	7½%	5 %	..	1¾ — 2¼	1¾ — 2¼	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., to 900 of £100, and 901 to 11,000 of £50 red.	..	..	..	..	96 — 99	96 — 99	..	..
99,261	Edison & Swan United Elec. Light, "A" shares, £3 paid, 1 to 99,261	5	Nil	Nil	..	0 — ¼	⅛ — ⅜	..	..
17,189	Do. do. "A" shares, 01—017,189	5	Nil	Nil	..	¼ — ½	⅜ — ½	..	..
44,023£	Do. do. 4 % Deb. Stock Red.	100	..	..	..	72 — 77	72 — 77	..	..
100,000£	Do. do. 5% 2n Deb. Stock Prov. Certs. all pd.	100	..	..	..	74 — 79	74 — 79	..	..
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	..	1⅜ — 1⅝	1⅜ — 1⅝	1 5/16	..
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	..	..	..	2¼ — 3	2¼ — 2¾	2 5/16	..
82,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock	Stock	..	..	..	97 —100	97 —100	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	..	9½ — 9⅝	9½ — 9⅝	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	..	..	..	93 — 98	93 — 98	..	..
200,000	Henley's (W. T.) Telegraph Works, Ord.	5	20 %	20 %	15 %	11¼ — 12⅛	11½ — 12⅝	..	..
200,000	Do. do. 4½ % Pref.	5	..	..	..	5 — 5½	5 — 5½	..	..
45,900	Do. do. 4½ Mort. Deb. Stock	Stock	..	..	..	107 —111	107 —111	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works	10	10 %	10 %	..	18½ — 19½	18⅜ — 19½	19 7/16	..
800,000£	Do. do. do. 4 % 1st Mort. Deb.	100	..	..	..	99 —102	99 —102	..	..
37,500	†Liverpool Overhead Railway, Ord.	10	1¼%	1¼%	..	4¼ — 4½	3¾ — 4	..	..
10,000	† Do. do. Pref. £10 paid	10	..	..	..	10 — 10½	10 — 10½	..	..
37,350	Telegraph Construction and Maintenance	12	20 %	20 %	20 %	34 — 37	35 — 38	37	36½
150,000£	Do. do. 4 % Deb. Bds., Nos. 1 to 1,500 Red. 1900	100	..	..	..	101 —104	101 —104	..	..
540,000£	Waterloo & City Railway, Ord. Stock	100	3 %	3⅛%	3⅛%	90 — 93	90 — 93	..	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ From Manchester Share List.

Bank rate of discount 3 per cent. (April 21st, 1904).

SHARE LIST OF ELECTRICAL COMPANIES (*continued*).—ELECTRICITY SUPPLY COMPANIES.

Present issue.	NAME.	Stock or Share.	Dividends for the last three years			Closing Quotations May 11th.	Closing Quotations May 18th.	Business done week ended May 18th, 1904.	
		‡	1901.	1902.	1903.			Highest.	Lowest
100,000	Blackheath and Greenwich Dist. Electric Light, Ord...	1	..	..	..	⅜ — ⅝	⅜ — ⅝	..	..
50,000	Do. 7 % Pref.	1	..	..	..	1 — 1¼	1 — 1¼	..	..
100,000	Do. 4½% 1st Deb. Stock, Prov. Certs. ..	100	..	..	..	117 —122	120 —125	..	..
20,000	Brompton & Kensington Electric Light Sup., Ord., 1 to 20,000 ..	5	8 %	8 %	10 %	10⅜— 11⅛	10⅜— 11⅛	10 1/16	..
20,000	Do. 7 % Cum. Pref. ..	5	..	..	..	10⅛— 10⅜	10⅛— 10⅜	..	..
250,000	Central Electric Supply 4 % Guar. Deb. Stock	100	..	..	..	107 —110	107 —110	..	..
50,000	Charing Cross and Strand Electricity Supply	5	10 %	10 %	8 %	7⅛— 7⅜	7⅛— 7⅜	7⅜	..
70,000	Do. do. do. 4½% Cum. Pref.	5	..	..	..	5⅛— 5⅜	5 — 5⅛	5⅜	5⅛
40,000	Do. do. "City Undertaking" 4½% Cum. Pref.	5	..	..	..	4⅜— 5	4⅜— 5	4 15/16	..
40,000	Do. do. 1903	5	..	..	..	4⅜— 5	4⅜— 5	4⅞	..
250,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	102 —104	103 —105	..	..
44,486	*Chelsea Electricity Supply, Ord.	5	4 %	4½%	5½%	6⅜— 6⅝	6⅜— 6⅝	..	..
150,000‡	Do. do. % Deb. Stock Red.	Stock	..	..	..	107 —110	107 —110	..	..
70,595	City of London Electric Lighting, Ord. 40,001—110,595 ..	10	5 %	5 %	5 %	10¼— 11	10¼— 10⅜	11	10⅛
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	..	..	..	13 — 14	13 — 14	13¼	..
400,000‡	Do. 5 % Deb. Stock, Scrip. (iss. at 115) all paid	..	..	..	..	121 —126	121 —126	..	..
300,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	..	..	..	101 —104	101 —104	102 3/4	..
40,000	County of London & Brush Prov. Electric Lighting, Ord. 1—40,000..	10	4 %	4 %	4 %	7 — 8	7½— 8½	8¼	7⅞
20,000	Do. do. do. 6 % Pref., 40,001—60,000..	10	..	..	..	11 — 12	11 — 12	..	..
400,000‡	Do. do. 4½% Deb. Stock	..	..	..	..	106 —109	106 —109	107⅛	107
250,000	Do. do. 4½% 2nd Deb. Stock	Stock	..	..	..	99 —102	99 —102	100⅜	100⅛
50,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	..	5⅜— 6⅛	5⅜— 6⅛	5 3/16	5⅛
80,000	Do. do. 6 % Cum. Pref.	..	..	..	..	5⅜— 5⅝	5⅜— 6⅛	5⅞	5⅛
140,000	Do. do. 4½% 1st Mort. Deb. Stock ..	100	..	..	..	104 —107	105 —108	..	..
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	12½	11½— 12½	11½— 12½	..	..
90,000	Do. do. do. 4 % Debenture Stock ..	Stock	..	..	..	102 —105	102 —105	..	..
110,000	London Electric Supply Corporation, Limited, Ord.	3	..	..	..	1¼— 1⅜	1¼— 1⅜	..	..
49,840	Do. do. do. 6 % Pref.	5	..	..	..	4½— 5	4½— 5	4¾	..
250,000‡	Do. do. do. 4 % 1st Mort. Deb. Stock Red	Stock	..	..	..	95 — 98	95 — 98	96½	..
100,000	Metropolitan Electric Supply, 1 to 100,000	10	6½%	7½%	8½%	19 — 20	19½— 19¾	20⅛	19 5/16
71,106	Do. do. 4½% Cum. Pref. 1—71,106, £3 paid ..	5	..	..	..	5⅜— 5⅝	5⅜— 5⅝	5 7/16	..
200,000‡	Do. do. 4½% 1st Mort. Deb. Stock	..	..	..	..	109 —113	109 —113	..	..
250,000‡	Do. do. 3½% Mort. Deb. Stock Red	Stock	..	..	..	97 —100	97 —100	..	..
10,852	Notting Hill Electric Lighting	10	6 %	6 %	6 %	12½— 13½	12½— 13½	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	14 — 15	14 — 15	15	14⅜
20,000	Do. do. do. 7 % Pref. 20,081 to 40,080	5	..	..	..	8 — 9	8 — 9	8¾	..
150,000‡	Do. do. do. 3½% Deb. Stock Red ..	100	..	..	..	97 —100	97 —100	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	..	2½%	4 %	3 — 3½	3 — 3½	..	..
50,000	Do. do. do. 4 % Deb. Stock	Stock	..	..	..	85 — 90	85 — 90	..	..
65,000	South London Electricity Supply, Ord.	5	..	1½%	3 %	3¾— 3⅞	3⅞— 4⅛	..	..
80,000	Urban Electric Supply, Ord.	5	..	..	..	4⅜— 4⅝	4⅜— 4⅝	..	..
80,000	Do. do. 5 % Cum. Pref.	5	..	..	..	4⅜— 4⅝	4⅜— 4⅝	..	..
110,000	Westminster Electric Supply, Ord.	5	10½%	12 %	13½%	12¼— 13¼	12¼— 13¼	13 1/16	12 13/16
28,141	Do. do. 5 % Cum. Pref.	5	..	..	..	6¼— 6¾	6¼— 6¾	6 7/8	6 11/16

*Subject to Founders Shares. ‡ Unless otherwise stated all shares are fully paid.

MARKET QUOTATIONS, Wednesday, May 18th.

CHEMICALS, &c.		Latest Price.	Week's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	per cwt.	22/-	..
a „ Oxalic	per cwt.	32/-	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	..
a „ „	per ton	£30	..
a Bleaching powder	per ton	£4 10	..
a Bisulphide of Carbon	per ton	£15	..
a Borax	per ton	£13	..
a Benzole (90 %)	per gal.	7/-	..
a „ (50/90 %)	per gal.	5/6	..
a Copper Sulphate	per ton	£21 10	..
a Lead, Nitrate	per ton	£24	..
a „ White Sugar	per ton	£31	..
a „ Peroxide	per ton	£27 10	..
a Methylated Spirit	per gal.	2/6	..
a Naphtha, Solvent (90% a 160° C).	per gal.	5/6	..
a Potash, Bichromate, in casks ..	per lb.	8d.	..
a „ Caustic (75/80%) ..	per ton	£24	..
a „ Bisulphate	per ton	£35	..
a Shellac	per cwt.	215/-	10/- dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a Recovered	per ton	£5 10	..
a „ Lump	per ton	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a Crystals	per ton	£3	..
a Bichromate, casks	per lb.	2½d.	..

METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£130	..
b „ Wire, in ton lots ..	per ton	£168	..
b „ Sheet, in ton lots ..	per ton	£166	..
p Babbitt's metal ingots	per ton	£48 to £130	..
c Brass (rolled metal 2' to 12') basis	per lb.	6¾d.	..
c „ Tube (brazed)	per lb.	8¾d.	..
c „ „ (solid drawn) ..	per lb.	7¾d.	..
c „ Wire, basis	per lb.	7d.	..
c Copper Tubes (brazed)	per lb.	9¼d.	..
c „ „ (solid drawn) ..	per lb.	9¾d.	..
g Copper Bars (best selected ..	per ton	£74	..

METALS, &c. (*continued*).		Latest Price.	Week's Inc. or Dec.
g Copper Sheet	per ton	£74	..
g „ Rod	per ton	£74	..
e „ (Electrolytic) Bars ..	per ton	£64	..
e „ „ Sheets ..	per ton	£80	..
e „ „ Rod ..	per ton	£74	..
e „ „ H.C. Wire	per lb.	8d.	..
f Ebonite Rod	per lb.	8/8	..
f „ Sheet	per lb.	8/-	..
n German Silver Wire	per lb.	1/6	..
h Gutta-percha fine	per lb.	8/-	..
h India-rubber, Para fine	per lb.	4/10½ to 4/11	inc.
i Iron, Charcoal Sheets	per ton	£18	..
i „ Pig (Cleveland warrants)	per ton	44/6	..
i „ Forgings, according to size	per ton	From £11	..
i „ Scrap, heavy	per ton	47/6 to 50/-	..
i „ Wire, galvanised No. 8 ..	per ton	£9 15	..
g Lead, English Ingot	per ton	£12 to £12 5	..
g „ „ Sheet	per ton	£13	..
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 2 6	..
d Mica (in original cases) small ..	per lb.	6d. to 1/	..
d „ „ „ medium	per lb.	2/6 to 4/-	..
d „ „ „ large ..	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/- to 1/2½	..
p „ rolled bars & rods	per lb.	1/- to 1/3	..
p „ „ strip & sheet	per lb.	From 1/1	..
o Platinum	per oz.	£4	..
p Silicium Bronze Wire	per lb.	9d. to 11d.	..
i Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
i „ „ in bars		£15 to £40	..
g Tin, Block	per ton	£127 to £128	..
g „ Foil	per lb.	1/6	..
n „ Wire, Nos. 1 to 16	per lb.	1/7	..
p White Anti-friction Metals—			
"White Ant" brand ..	per ton	£12 to £62	..
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	8d.	..
j „ 6 lea. Flax	per lb.	5½d.	..
j „ 8 ply 10 lbs. Russian ..	per lb.	4 13/16d.	..
j „ 10 lbs. Russian, single ..	per lb.	4¼d.	..
j „ 180 lbs. Jute rove	per ton	£11	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£25 5	..

Quotations supplied by Messrs.:—*a* G. Boor & Co.; *b* The British Aluminium Co., Ltd.; *c* Thos. Bolton & Sons., Ltd.; *d* F. Wiggins & Sons.; *e* Frederick Smith & Co., *f* India-Rubber, G.P. and Teleg. Works Co., Ltd.; *g* James & Shakspeare; *h* Edward Till & Co.; *i* Bolling & Lowe; *j* Walter H. Hindley and Co., Ltd.; *k* Morris Ashby, Ltd.; *m* W. T. Glover & Co., Ltd.; *n* P. Ormiston & Sons; *o* Johnson, Matthey & Co., Ltd.; *p* The Phosphor Bronze Co., Ltd.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

	Locality.	Week ending	Receipts for the week.		No. wks.	Total to date.		Miles open.	
			£	£*		£	£*		*
Co.	Aberdeen	May 14	1,177	+229	50	60,100	+12,318	10	—
	Birmingham ..	„ 14	5,344	+446	20	104,009	+ 5,810	3½	—
	Bournemouth ..	„ 11	977	+ 29	93	81,747	—	10½	—
	Blackburn	„ 13	782	+ 58	7	6,314	+ 394	13½	—
	Blackpool	„ 12	502	+ 96	6	4,096	+ 392	8½	—
	„ —Fleetw'd	„ 14	299	— 2	20	4,924	— 256	7½	—
	„ —Lytham	„ 5	253	—	27	4,925	+ 4,346	7½	—
	Bolton	„ 15	1,788	+154	7	11,865	+ 113	25	—
	Bradford	„ 14	4,055	+784	6	27,424	+ 4,911	46	—
	Brighton	„ 15	866	+ 87	—	5,656	—	7½	—
	Bristol	„ 13	4,788	+ 84	—	—	—	28	—
	Devonport ..	„ 6	516	+ 66	18	8,499	+ 1,181	5	—
	Dudley—Sto'rb'ge	„ 6	814	+ 71	18	13,8-5	+ 609	18⅔	—
	Gateshead ..	„ 6	907	+ 86	18	15,661	+ 848	10½	+ ¾
Tram.	Gr'n'k—Pt. Glsgw	„ 6	541	+ 42	18	8,6-8	+ 660	7½	—
	Hartlepool ..	„ 6	282	+ 55	18	4,568	+ 481	6⅔	+2
	Oldham—Ashton	„ 6	562	+ 15	18	9.939	— 489	8	—
Elec.	Potteries	„ 8	1,677	+111	18	29,991	+ 2,499	28⅔	—
	Southport	„ 6	395	+ 78	18	4,77o	+ 332	5½	—
	South Staffs. ..	„ 6	798	— 57	18	13,720	+ 80	21½	—
	Swansea	„ 6	494	+ 24	18	8,5 0	+ 313	5½	—
	Wolverhampton ..	„ 6	399	+ 12	18	6,298	— 262	10½	+8
	Yorks. Wool Dist.	„ 6	654	+854	18	9,845	+ 4,826	6	—
	Miscellaneous ..	„ 6	2,480	—	18	37,832	—	—	—
	Burnley	„ 15	578	+267	—	—	—	10½	+3½
	Burton-on-Trent ..	„ 15	321	—	41	13,579	—	8½	—
	Cardiff	„ 7	1,920	+190	—	10,469	+ 481	1	—
	Chatham & District	„ 12	557	+ 34	19	10,057	+ 1,701	8·58	—
	Cork	„ 12	452	— 11	19	7,716	— 296	9	—

* Compared with the corresponding period of 1903.

	Locality.	Week ending	Receipts for the week.		No. wks.	Total to date.		Miles open.	
			£	£*		£	£*		*
	Dover	May 14	195	+ 2	19	3,461	— 186	3	—
	Dublin	„ 13	4.792	+ 405	20	85,669	+ 2,102	47	+ ½
	East Ham	„ 14	693	+ 58	—	4.728	+ 601	5	+ ½
	Glasgow	„ 14	14,113	—1678	50	681,897	+59,252	70	+5½
	Halifax (2 weeks) ..	„ 4	2,749*	+ 479	5	6,974	+ 439	33	+2½
	Huddersfield ..	„ 14	1,188	+ 82	6	—	—	28	—
	Hull	„ 14	1,992	—213	6	13,094	+ 847	13	+2½
	Ilkeston	„ 11	126	—	—	8.079	—	4	—
	Ipswich	„ 14	401	—	7	2,730	—	9	—
	Isle of Thanet ..	„ 14	432	+ 24	19	5,866	— 341	10½	—
	Leeds	„ 14	5,241	+398	—	39,385	+ 3,215	81½	+2
	Liverpool	„ 7	10,067	+421	19	183,878	+ 4,875	108	—
	London C. C. ..	„ 7	10,728	+2215	5	58,163	+12,085	82½	—7
	Manchester	„ 14	11,355	+826	6	70,069	+ 1,537	131½	—
	Newcastle	„ 14	3,628	+474	—	—	—	17	—
	Portsmouth	„ 14	1,714	+250	—	11,695	+ 1,280	14½	—
	Salford	„ 9	3,685	+656	—	22,015	+ 2,687	30	—
	Sheffield	„ 15	4,574	+446	7	82,944	+ 985	32½	+4½
	Southampton ..	„ 12	903	— 36	—	—	—	9	—
	Southend-on-Sea ..	„ 11	253	— 20	6	1,667	+ 127	6½	—
	Sunderland	„ 15	1,185	+112	6	7,500	+ 219	20	+3
	Tyneside	„ 1	238	+ 90	18	5,318	+ 794	8·9	+*
	West Ham	„ 12	688	—	11	5,706	—	4·56	—
	Wolverhampton ..	„ 10	542	+110	—	—	—	7·563	—
	Cen. London Rly. ..	„ 14	6,708	—455	20	138,488	— 1,475	6	—
	City & S. Lon. Rly.	„ 15	2,532	—252	20	60,781	— 2,092	6½	—
	Duolin—Lucan Rly.	„ 15	136	+ 16	20	1,978	+ 126	6½	—
	L'pool Overh'd Rly.	„ 15	1,656	+ 53	20	31,163	+ 144	6½	—
	Mersey Railway ..	„ 14	1.491	+117	19	27,296	+ 6.449	4½	—

INSTITUTION OF ELECTRICAL ENGINEERS.

POWER STATION DESIGN.

By C. H. Merz, Member, and Wm. McLellan, Associate Member.

(*Paper read in London, April 28th*, 1904.)

(*Continued from page* 805.)

Whether the final form of turbine will be of the Parsons type, or whether it will be modified by the use of expanding nozzles* or by other device, it is impossible to say at present. The turbine has, however, already reached such a high standard of efficiency compared with that obtainable within the temperature limits, that unless these limits† are themselves largely varied, it would seem to resolve itself almost solely into a question of first cost. Turbines of any type obviously possess certain inherent advantages over reciprocating engines—they are cheap, simple, take up little room, and have no vibration. If therefore they can be made to run with reasonable economy in steam consumption and repairs, they fulfil the essential requirements for power supply as enumerated in the introduction much more effectively than can the best reciprocating engine, whether high or low speed.

"Reliability of supply" is met by their simplicity of construction, which also results in a small repair bill and a small labour bill for operation. "Economy of production" is met (*a*) by their low first cost (which is further helped by the small space occupied, a cheap foundation, and absence of vibration), and (*b*) by their economy in operation and saving in repairs, oil, and labour.

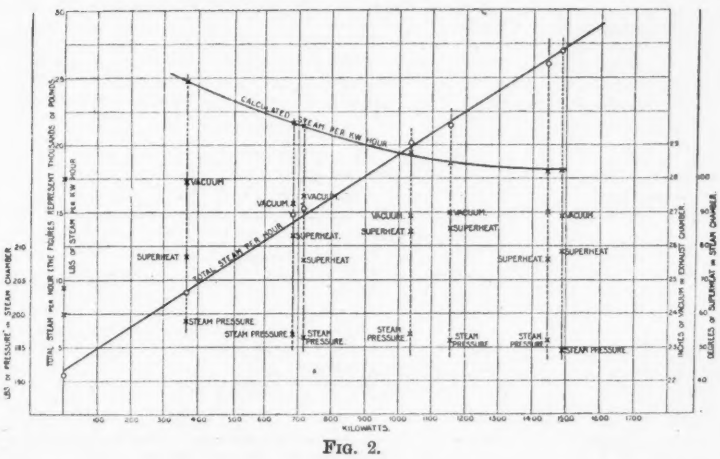


Fig. 2.

To any one with experience of large turbines, there can be little or no question about any of these points, but as a great deal of information as to actual experience has not yet been published, we may briefly refer to results obtained at Wallsend. We attach curves showing the steam consumption‡ of a 1,500 to 2,000 kw. turbine, which was installed at the end of 1901. (Fig. 2.) The tests given were made after the turbine had run about 900 hours. After running 6,000 hours practically the same tests were repeated, and within the limits of observation the same results were obtained. The following table shows the hours of running, oil consumption, &c.:—

Log of No. 10 Turbine Installed at the Neptune Bank Power Station of Newcastle-upon-Tyne Electric Supply Co.

Period.	Hours running.	Hours out of commission.	Remarks.
Dec., 1901, to Aug. 1902	2,030	—	Thrust adjusted.
Aug., 1902, to Sep., 1902	471	4	Do. do.
Sep., 1902, to Oct., 1902	516	2	Thrust examined.
Oct., 1902, to Nov., 1902	502	12	Governor overhauled.
Nov., 1902, to Aug., 1903	1,788	18	Relay valve examined, thrust examined, new oil disc fitted.
Aug., 1903, to Dec., 1903	1,596	4	Thrust examined.
Dec., 1903	549	12	Repairs to governor throttle valve chest.
	7,512	52	

Total hours run: 7,512. Out of commission for inspection and repairs to turbine: 52 hours. Oil used: 150 gallons at 3s. 6d. per gallon.

It will be noticed that the 2,000-kw. turbine ran 7,500 hours without ever having been opened up, and only on two occasions have the bearings needed any re-setting in order to keep the clearance correct, although they were three times examined and the clearance tested. In fact, the only faults of any kind which it has been necessary to repair have been the re-lining of one of the governor throttle valve chests and the renewal of an oil disc.

Steam turbines seem in every respect to be specially suitable for power scheme purposes, and although they have taken many years to develop, it is probable that had there been a demand ten years ago for 2,000-kw. generating sets, turbo-alternators would have been the only large size generating units in extensive use at the present day. Their earlier commercial success was prevented by the fact that there was only a demand for small sizes (300 kw. and under), at which sizes any superiority which the turbine even at the present time possesses over reciprocating engines is due to saving of labour and oil rather than to either lower cost or reduced steam consumption. In large units the adoption of turbines materially reduces the capital cost of a power station. This reduction amounts to from 15 per cent. to 20 per cent over the whole station even on present market prices, and it will be much greater when the manufacture of turbines has become as completely standardised as that of reciprocating engines. If the reduction be calculated on the engine and dynamo alone, the percentage is naturally very much greater. The mere fact that this saving is not available in small sizes greatly assists a power company in its competition with private plants, as a private user, utilising, as he must, relatively small units, does not reap anything like the same advantage as a power company from the adoption of turbines either in first cost or in steam consumption. We are here discussing a station for power supply which involves alternating units, as large continuous current turbo-generators, due to the troubles of commutation at high speed, have still a somewhat limited field.*

The high thermal efficiency of gas engines has long rendered their use attractive to power station engineers, more especially in the south of England, where coal is expensive, but, although we may eventually look forward to the time when a gas motor fulfilling the requirements of a power station will be obtainable, it can hardly be denied that, for this purpose, the gas engine has not at present attained the same perfection as the steam turbine.

Apart altogether from the importance of utilising more efficiently the heat energy in coal, there are large possibilities in utilising gas which is a waste product, or which is obtainable in conjunction with some manufacturing process. These possibilities make it particularly desirable to utilise gas direct in the prime

* With the exception of those of the Parsons type, all turbines have some form of expanding stationary nozzle.

† The principal sources of loss in a turbine are leakage, eddy or fluid friction, and incomplete expansion. It is safe to assume that in no turbine will this be reduced to below 15 per cent. We may therefore assume that the best attainable result is that the turbine should return as useful work 85 per cent. of the total energy contained in steam between specified boiler and condenser temperatures. Assuming the efficiency of the dynamo, including the losses in bearings, excitation slip-rings, oil pumps, &c., to be 90 per cent., then 1 kw.-hour at the switchboard will, with steam at 200 lbs. pressure superheated 200° F., and with a condenser temperature of 100° F., require a consumption of 11·85 lbs. of steam (from Rankine's formula). Turbines have already been constructed consuming 14·5 lbs. of steam per kw.-hour at full load with a steam pressure of 190 lbs. superheated 200°, and with 27·9 in. of vacuum in the condenser, so that future developments must be looked for rather in higher efficiency at low load, and in the adoption of higher pressure or greater superheat.

‡ The data are taken from the log sheets of the Newcastle-upon-Tyne Electric Supply Co., who have operated two 2,000-kw. turbo-alternators at their Neptune Bank power station, and who are now installing a further 10,000 kw. of turbines at their new Carville station. It is thought that the facts stated justify conclusively the installation of the trial turbines three years ago, and the orders for new turbines which the company have since placed.

* In cases where it is necessary or desirable to generate continuous current, turbo-alternators plus rotary converters, even when the latter have to be installed in the same building, are frequently justifiable. If it be a question of a 500-volt network for traction or lighting and the radius to be dealt with does not justify one or two sub-stations, rotary converters would be installed in the power house, and the generators would be of the revolving field type, and wound for 330 volts so as to avoid step-down transformers. Switchgear between generator and rotary would be dispensed with, and each rotary and turbo set would be treated as one unit. The result would be:—Capital Cost.—Rotary plus alternator as against low-tension direct-current generator, an increase in first cost of perhaps £1 per kw., which should be more than saved by the reduced cost of turbines compared with reciprocating engines. The rotary would not, of course, cost as much as the continuous-current dynamo for the same output. Annual Cost.—A loss of, say, 5 per cent. in the rotary converter, as against the saving in steam, oil, and repairs, by the use of turbines.

mover without the agency of steam. This paper, however, refers essentially to the design of power stations where coal is the fuel, either in a boiler or in a gas retort. The conclusions drawn under this section must in no sense be taken as implying that in the opinion of the authors gas engines are impracticable for power stations where waste gas from blast furnaces or other source is available. (See footnote to this column.)

It is hardly open to question that steam turbines with a given amount of spare plant give greater security of supply than gas

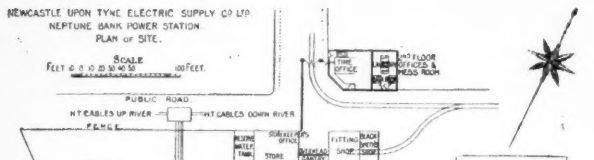


FIG. 3.

engines. It is also evident that the use of steam turbines simplifies the remainder of the power station and generally the system as a whole. Even if we say nothing about the difficulties attending the use of rotary converters of 40 or 50 cycles fed through long lengths of cable with gas engine driven plant, we doubt whether a balance sheet can be drawn so as to come out favourably to the gas engine at the present moment.* The saving of coal varies, of course, in different localities, but even allowing for slight differences in favour of the gas engine compared with the steam turbine in this direction, we would at present, for all ordinary power station purposes in this country, decide in favour of the steam turbine. We would draw our balance-sheet as follows:—

Gas Engines.	*Turbines.*
Low coal bill.	
High oil costs.	Low oil costs.
High labour costs.	Low labour costs.
High repair costs.	Low repair costs.
and (most important of all)	and (most important of all)
High capital cost.	Low capital costs.

Low capital costs are even more important in this connection than in others, as depreciation charges are necessarily higher in gas engines than in turbines. Of course, such improvements in gas engines may be made as will result in their superseding steam turbines, but if the advocates of gas engines are correct in stating that the present type of gas engine is being rapidly improved upon, it is the more advisable to install at first a cheap plant in order to diminish the cost of superseding it when gas engines approach finality in development.

2.—General Arrangement.

As we are dealing more particularly with a station for power supply, we must necessarily assume that land is reasonably cheap, and that the site is of ample area in order to allow for future extensions. It is also desirable, in order to permit the transmission cables to radiate in all directions, that the site should be located well within the area to be served, and not at its extreme boundary, though this latter consideration may be outweighed by the necessity of choosing the site so as to secure as cheaply as possible the raw material necessary, whether coal, waste gases, water or stores.

The buildings necessary for a large power station and its operation are:—

(*a*) Main buildings containing the generating machinery.
(*b*) Switch house.
(*c*) Offices.
(*d*) Stores and repair shops.

The above buildings are frequently grouped into one block, and although this may result in some saving, it would seem a mistake if we follow out the principle of sub-division. In the case of a steam station it is necessary, in order to avoid undue losses in steam pipes, to put the boiler house adjacent to the engine house.* The offices, stores and repair shops, however, should, in the opinion of the authors, always be placed away from the main power station buildings. The advantage of doing this is, that they need not be built so substantially, and all fire risks are avoided. Their relative position, however, both to the first instalment of the power station and to extensions, requires careful consideration. In deciding upon their location, the following points should more especially be borne in mind:—

1. Ease of extension of the auxiliary buildings themselves.
2. Ease of transport of apparatus from the stores to the repair shop and from both to the main buildings.
3. Delivery of goods to stores.
4. Position relative to the works main entrance.
5. Any outside purpose (*i.e.*, in addition to dealing with the power station) which the auxiliary buildings may be called upon to serve.

In commencing the construction of a power station, the auxiliary buildings, repair shops, stores, and all sidings, should be put down before the main buildings are started. This will enable considerable economy to be effected in the cost of constructing the main buildings. Figs. 3 and 4 show the general arrangement of auxiliary buildings at Neptune Bank and Carville.†

With regard to the general lay-out of the main buildings, the modern station is tending towards what may be called the complete unit system.‡ For a large power station this tendency might, with advantage, be carried further than is the general practice at present, so that the only junction between the various units will be:—

1. At the railway siding or other source of coal supply.
2. At the river or other source of circulating water supply.
3. At the main bus-bars.

In fact a large power station may with advantage be so designed that the boiler-house plant, the steam piping system, the generating system, and the switchboard, may all be entirely sub-divided into different units. The adoption of very large generating units has increased this tendency in recent power stations, which are now, in many cases, designed more after the lines of what might be termed marine practice—that is to say, each large generating set is provided with its own boilers and auxiliaries, and it is therefore under normal conditions entirely separate from the other units.

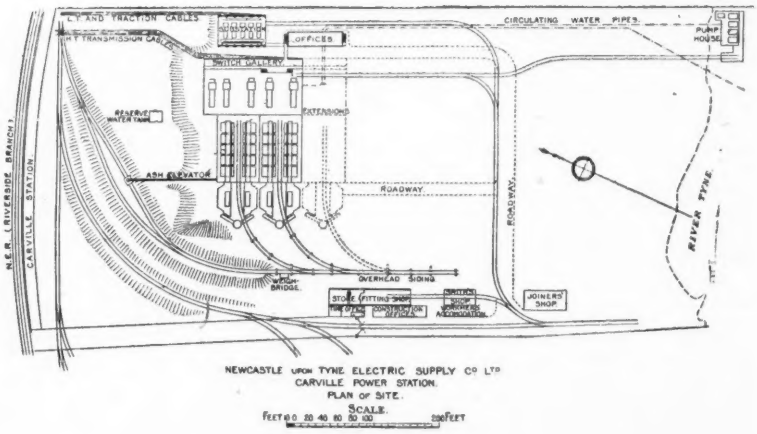


FIG. 4.

stores and fitting shop are all separated from the main buildings, as is also the North-Eastern Railway sub-station. (*b*) Easy communication has been provided between the offices, the main switch gallery, and the N.E.R. sub-station, by means of an overhead enclosed gangway. (*c*) Siding communication is provided between the stores and repair shops and the main buildings. (*d*) An overhead hand traveller connects the stores and repair shops. (*e*) Both a railway siding and a road run into the stores. (*f*) Stores and construction offices are combined with time office and main entrance to works. It may be mentioned that in this particular case these buildings also act as construction offices and repair shops for the whole of the Newcastle Co.'s system.

* It is at present almost essential to use 40 or 50 cycles for power supply in order to deal with alternate current lighting. If gas engines were used, it would probably pay to utilise asynchronous alternators on the gas engines, and to have one turbine always running on the circuit to keep the turning moment steady, and generally to control the system. It is the intention to do this in the Blaydon power station which the authors are at present erecting.

* Some engineers prefer to keep the switchgear in an entirely separate building, and there is much to be said in favour of this course, especially if the number of feeders is greatly in excess of the number of generators. A modification of the idea would be to build a separate feeder house. A decision on this point must, to a great extent, depend upon local conditions, the extent of the system, and the importance which the power station under consideration bears to the system as a whole.

† It will be observed in the case of Carville (*a*) that the offices,

‡ By a complete unit is not necessarily meant one generating set—a unit may consist of two or more generating sets with boilers and auxiliaries.

So far as the nature of the building itself is concerned, this is governed solely by the necessity for keeping down capital expenditure, and it is, practically speaking, in no way affected by questions relating to reliability of supply and low running cost. On this account the structure may be treated merely as a shell to contain effectively, but as cheaply as possible, the generating plant. A steel-framed structure is in every way the most satisfactory, the filling-in between the various columns being merely of the nature of a weather-proof screen wall, depending for its stability on the steel framing. This screen can be of brick, concrete, or corrugated iron—the last has the advantage that it can be more easily altered.* The complete buildings will consist of three components:—

1. The boiler house (or gas generator house) to which the coal is delivered.
2. The engine room containing engines, generators, and auxiliaries.
3. The switch galleries or separate switch house, from which the generation of energy is controlled, and from which the cables emerge.

In order that each of these sub-divisions may permit of general systematic extension to meet as far as possible all future engineering developments, the switch galleries must run parallel to the longitudinal axis of the engine room,† the boiler house being placed along the side of the engine house opposite to the switch gallery. In the boiler house provision will be required for coal and ash-handling plant, and for the storage of a considerable quantity of coal, so that even if a sudden strike should cut off the usual supply, the station staff may have a sufficient coal reserve to allow of them negotiating for a supply from other sources. In order to secure the shortest possible steam pipe, it is imperative that the boilers should be located directly opposite the engines they normally supply. For similar reasons these engines should be closely adjacent to their condensers, which, in turn, should be almost directly above the circulating water inlet and outlet mains. On the electrical side similar reasons hold; the generator panels should be as close as possible to their respective generators. In short, the whole lay-out should be designed with the idea of avoiding crossings and of obtaining the shortest and most direct run of all connections, whether piping or cables.

(To be continued.)

* This feature, namely, that it should be possible with the minimum of expense to take advantage of radical improvements, is also worthy of consideration in connection with the site chosen.

† This is advisable whether they are in a separate building or not. One serious objection to the placing of the switchboard at the end of the building is the concentration of leads running to the board, the practical impossibility of avoiding crossings of cables, and the fact that the width of the building limits the possible extension of the switchgear.

LOSSES IN CABLE SHEATHS.

By M. B. Field.

(Abstract of Paper read in London, April 14th, 1904.)

Although it is understood that single-core cables carrying alternating currents must not be laid in separate iron pipes, it is considered permissible to lay concentric or three-core (three-phase) cables in iron pipes, for when both go and return conductors are included in the same cable, so that the algebraic sum of the currents is zero, there cannot be any closed magnetic lines entirely surrounding the cable due to the currents which it carries.

In a case where three cables carrying 600 to 1,000 amperes each, at a frequency of 25, were laid through short lengths of wrought-iron pipe, the temperature of the latter rose to such a degree as to endanger the insulation of the cables. When three-core three-phase cables were substituted for the single cables, the pipes remained cool. Similarly, two single cables forming the lead and return of a single-phase system can be laid in the same pipe without generating serious hysteresis or eddy losses in the iron.

Nevertheless, a considerable external magnetic field may be set up by a three-phase current in a three-core cable, giving rise to disturbances in telephone circuits, eddy currents in the lead sheath or iron pipe, and even earth currents. Similar results will ensue if the conductors of a so-called concentric cable are not truly concentric, or if concentric or three-core cables connected in parallel at both ends are not exactly balanced in resistance, so that the algebraic sum of the currents in either cable is not zero.

Taking the case of a single cable lying in an iron pipe, the author shows that both hysteresis and eddy current losses take place in the latter; the hysteresis loss alone may easily be of the order of 1 kw. per cb. ft. If two cables be lead sheathed, and laid in bitumen on the solid system, a longitudinal E.M.F. will be induced in the sheath of each, in such directions that if the sheaths be connected at the ends a current will flow round the closed circuit thus formed. Even if the cables were laid in the earth, the current in the sheaths would not be affected, except by the reaction of similar currents induced by the stray field in the surrounding soil, which are generally negligible. The author proceeds to show that in an actual case, with a load of 200 amperes, the current circulating in the sheaths may attain a value of 64·5 amperes, causing a loss of 4·7 kw. per mile of cable. Returning to the case of a cable laid in an iron pipe, and taking actual values, the author finds a possible eddy-current loss of 4·15 kw. and a hysteresis loss of 0·125 kw. per cb. ft. with a load of 500 amperes. In thick pipes the hysteresis loss decreases, but the eddy current loss then increases considerably. A number of charts showing the distribution of the magnetic fields at various stages due to the currents in three-core and twin cables are given in the paper, and it is shown that in the case of a three-core cable carrying 200 amperes per core, at 60 cycles, the loss in the lead sheath may amount to 0·67 kw. per mile. The addition of an earthed copper shield under the lead, to comply with the Board of Trade requirements, would considerably increase the loss, bringing it under practical conditions up to 2 kw. per mile in the case of the cable above mentioned. If the cable were laid in an iron trough, or steel armoured, the loss would be further increased, and might quite possibly amount to 8 or even 18 kw. per mile, though it is very difficult to calculate owing to the irregularity of the magnetic field in the iron. The author suggests that the loss due to the copper shield might be obviated by winding on the copper strips with a lay as different as possible from that of the cores, and applying a thin coat of paint to them before lead-sheathing. A "concentric" cable, carrying 200 amperes, with an eccentricity of $\frac{1}{8}$ in., would produce an E.M.F. in a pilot wire 4 in. away of 3 or 4 volts per mile, causing a very loud humming in a telephone connected with the latter.

In two appendices the author gives the detailed calculations relating to the theorems discussed in the paper.

There was no discussion on the paper, but we have received some notes from Mr. G. L. Addenbrooke, which we abstract below:—

Mr. Field's paper deals with matters of very great practical importance. Different experimenters have found traces of losses such as Mr. Field describes, but the matter being a complicated one, these reports have hitherto lacked coherence, and there being a possibility of getting losses from three distinct sources, namely, dielectric hysteresis, eddy currents, and hysteresis in the iron sheaths, it has been difficult to distinguish what proportion of the effects observed has been due to one or other of these different causes.

In some experiments I undertook at Messrs. W. T. Henley's Telegraph Works, nearly two and a half years ago, intended chiefly to go into the question of dielectric hysteresis, effects were observed of the character alluded to by Mr. Field. One set of concentric cables had a bare lead sheath and were coiled on drums. An attempt was made to measure the dielectric losses in this cable between the inner conductor and the lead sheath. The losses were, however, found to be so considerable that it was evidently useless to continue the experiment in this form. The lead evidently acted as the secondary of a transformer sufficiently for heavy and considerable losses to take place in this. This points to the fact that lead-covered cables carrying alternating currents should not be laid in metallic connection with conductors which may form a return circuit.

Next, several measurements having been made on lengths of cable which were unarmoured, an armoured length was substituted, and in this the losses were uniformly higher, the cables being concentric in both cases, and the tests taking place between two conductors. At 3,000 volts the power factor was 1·45 per cent., while with armoured cable the power factor was 1·62 per cent. Experiments were made at other voltages with somewhat similar results. The effect is not large under these circumstances, but then with concentric cables the external field must be small. I had no opportunity of making a similar set of tests on three-phase cable under similar circumstances, where one would expect the effects to be somewhat greater.

In these experiments the current flowing through the cable was merely the current used for electrostatically charging it. With the actual currents flowing in practice through the cable, the effects might be very appreciable. The only way to determine them, it seems to me, would be to take a length of cable having a non-inductive resistance at one end in which the energy of the current passed through the cable would be dissipated. If then a steady alternating current were passed through the cable, and simultaneous measurements could be taken at both ends, both of the current and watts lost; deducting the calculable loss in the conductor of the cable, it ought to be possible to arrive at any other losses which might take place.

I would be happy to give any assistance in my power in the conducting of such a set of experiments, as I think it would be for the general benefit of the industry that they should be made.

Dublin Section.

The annual general meeting of the Section was held on 13th inst. Mr. Mark Ruddle was chosen as chairman, and Mr. P. S. Sheardown as vice-chairman, for the coming session. A discussion on Messrs. Meiz and McLellan's paper, "Power Station Design," and one on an improved form of apparatus for separating iron from other metallic particles, described by Mr. J. H. Dowling, followed.

The Section afterwards adjourned till November.

Fires in Dry-Cleaning Works.—Richter has already shown that the fires which frequently occur in dry-cleaning factories when woollen fabrics are being taken out of the benzine baths are due to electrical discharges between the positively charged wool and the negative liquid. He has also shown that such fires can be prevented by dissolving in the benzine from $\frac{1}{20}$ to $\frac{1}{10}$ per cent. of magnesium oleate. G. Just finds that the magnesium oleate acts in this manner by increasing the conductivity of the benzine to such an extent that electrostatic charges quickly disappear. He has attempted to discover some substitute for the magnesium oleate, but without success, other substances being either not sufficiently soluble in the benzine or not capable of conferring upon it sufficient conductivity.—*Zeits. Elektrochem.*, 1904, x., 202.

FUEL ECONOMY IN STEAM PLANTS.

Writing under the above title, in *Cassier's Magazine*, Mr. J. B. C. Kershaw says that of all raw materials, fuel appears to be the only one whose sale is conducted on rule-of-thumb methods instead of by exact tests. Coal is coal in the eyes of the user. Probably this unfortunate method of sale has arisen, because under conditions of practice a bad coal in large pieces is more satisfactory than a good coal in the form of dust. If all coal were alike in its size, it would obtain a price more nearly commensurate with its calorific capacity.

He condemns the principle of secret gifts and commissions as tending to influence the results obtained where bulk samples of coal are tested before making contracts. Such an influence might be combated by means of the calorimetric test of the coal, and he quotes Mr. Stromeyer in support of the unreliability of practical or bulk tests of coal, which are so much influenced by the fireman, or even by the boiler employed. He advises also the proximate analysis method of ascertaining the proportions of fixed carbon, volatile hydro-carbons and ash, rather than the elementary or complete analysis, and he would have samples taken and tested at intervals during the run of a contract, in order to keep the seller up to contract specification, for the ash content of coal from one colliery may vary from 6 to 20 per cent. Moreover, the working out of a seam of coal may occur in that particular colliery during the run of a contract, and another seam may produce very different fuel.

It is surprising how a small *douceur* will sometimes induce a fireman to struggle on with a poor coal. Large users of coal do often have their supplies properly tested, but fuel analysis is not work that can usually be carried out satisfactorily by a non-expert, nor can samples be taken that are really representative. The crushing and mixing and quartering are simple operations. It is the taking of a fair sample that is difficult. Considering the casual way in which a truck of coal is filled, it is improbable that a very fair sample would be that secured by taking a barrowful of coal when the truck has been half emptied.

Dealing with feed water, an analysis for lime salts should be made to determine the proper system of softening to be employed, and it must not be overlooked that a water will change its character with the seasons and rainfall, and may, with advantage, be analysed periodically. Well waters, however, probably vary but little, and in a chalk well yielding mere carbonate scale, the phenolpthalein test will usually be of great assistance in regulating the process of treatment. Ordinary salt, in these days of high pressures and temperatures, may also produce serious corrosion, and should be guarded against.

On the question of combustion, Mr. Kershaw states truths that have often been emphasised in these columns, reiterating the three essentials of complete and economical combustion, viz., air in sufficiency, temperature, and mixture. It is the second essential of temperature that is usually wanting, and in water-tube boilers the third is very often absent owing to the mistaken way in which the furnaces are arranged. The absence of temperature induces the use of excessive air to prevent smoke, though it is not perhaps quite clear why this effect is secured. Nor is the loss due to excess of air usually recognised, and the use of air for diluting temperature has even been urged by a correspondent in our columns, on the erroneous assumption that the heat was there all the same. There is a confusion of heat with temperature, as though the gases of a boiler furnace escaped at atmospheric temperature, in which case such confusion would do no harm.

With waste gases at 600° F., the loss by excess of air may be 13 to 68 per cent. of the fuel burned, the latter loss representing only 3 per cent. of CO_2, and even 2 per cent. has been noted. Mr. Kershaw thinks that an average of 14 per cent. of CO_2 should be secured in good practice, though it is by no means secured in ordinary practice. With the cheaper fuels there is always smoke with insufficient air, so that there is really very little danger of loss from the production of CO. or carbonic oxide. This sort of loss, however, may easily occur with coke fuel or anthracite, and admission of air above the fire is quite as needful as with bituminous fuel.

Incidentally, it should be mentioned that closed household anthracite or coke stoves ought to have an air admission above the fuel level to burn off the carbonic oxide, and economise fuel. Mirrors for viewing the chimney top from the firing floor are desirable adjuncts to a fireman's equipment, and damper regulation must, of course, be possible from the firing floor. It is satisfactory to find Mr. Kershaw condemning the common boiler settings which are accepted unfledged from the boiler-makers, and passed by engineers without a thought that there is anything better. He advocates what has been advocated by us for years past—viz., a sufficient capacity of refractory combustion space to ensure mixture and temperature, and he would like to go further, and attempt regenerative effects which have not yet been attempted to any serious extent—at least, in stationary boiler work.

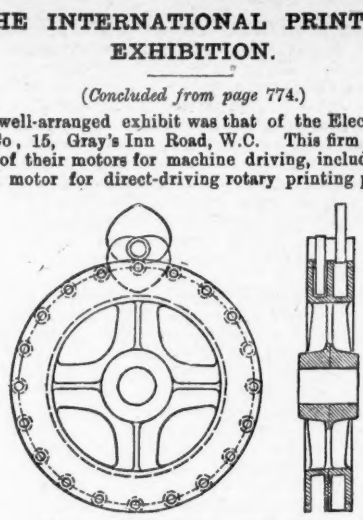
We do not quite agree that the high temperatures of glass furnaces are quite a fair parallel. The fuel used in a glass furnace is very largely wasted because the glass absorbs very little heat, not being evaporated like water in a boiler with latent heat effects. In a Lancashire boiler it is probable that much benefit would accrue from lining the furnace tubes behind the bridge with firebricks, and admitting air at the bridge. The lining of the furnace has been tried, but it is difficult to maintain. Possibly the lining would endure better behind the bridge.

Finally, the analysis of the waste gases is recommended, especially the determination of the CO_2, which is, after all, the principal thing to know; and the author shows a simple arrangement he has devised for this purpose.

THE INTERNATIONAL PRINTING EXHIBITION.

(*Concluded from page 774.*)

Another well-arranged exhibit was that of the Electromotor and Dynamo Co, 15, Gray's Inn Road, W.C. This firm have on view specimens of their motors for machine driving, including a 20-h.p. slow-speed motor for direct-driving rotary printing presses. The



Grisson Patent Reducing Gear.

Grisson patent reducing gear is shown in operation. This gear consists essentially of a double cam and roller wheel, the cam being made of special hardened steel—and the roller wheel of cast-iron, with hard steel rollers; the guaranteed efficiency of the gear at full load is 95 per cent., and it runs completely enclosed and in oil. We understand that Messrs. Waterlow & Sons, Ltd., have had 14 of

Electric Pulley Block and Hook.

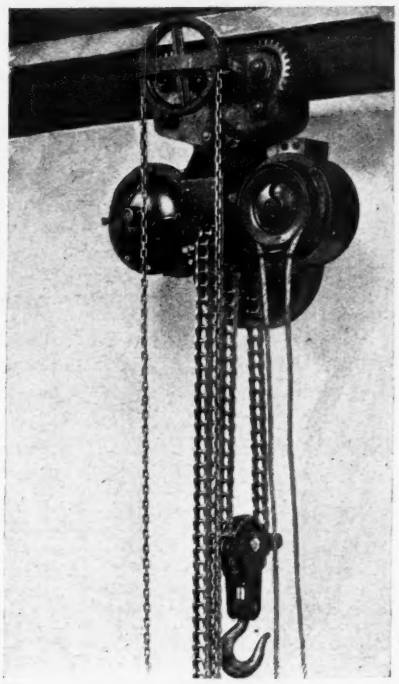
these gears running in connection with their printing machinery for some time, transmitting power from motors also supplied by the same firm.

A special feature of this stall was the electric pulley block, fitted either with a hook for rigid position, or with hand or power travelling gear and trolleys, the apparatus being shown in operation lifting a reel of paper. The gear consists of a small motor driving through a raw hide pinion and cast spur-wheel, the hoisting gear. On the opposite side of the latter is placed the starting and reversing controller, operated from the floor by means of a rope passing over a pulley. The apparatus is made in sizes of ½ to 10-ton lifts, and in regard to the 2-ton size, we were assured that 200 lifts per day, with energy at 2d. per unit, would cost no more than 3s. per week. We learn that these pulleys are being adopted by certain London daily papers. The firm also show

a compact electric lift gear on a common base plate, and fitted with automatic brake control, several electric crane gears and motors.

Other exhibitors who make a speciality of electrical work were Messrs. F. A. Glover & Co., Ltd., of Garrick Street, E.C., who show a combined high speed engine and dynamo suitable for small power and lighting work, and numerous electric fans and ventilators; Messrs. F. W. Potter & Co., Phipp Street, E.C., who specialise in "Wing" direct current ironclad motors (⅛ H.P. to 6 H.P.) and "Wing" electric fans, starting and regulating switches, &c.

Messrs. Henry F. Joel & Co. show a "Zone" motor and dynamo in operation. Messrs. Lennings & Huesing, of Hamburg, exhibit their "Univereal" automatic paper feeder, which, it is interesting to



Travelling Electric Pulley-block; Electromotor and Dynamo Co.

note, is electrically controlled, so that the machine will be stopped in the event of irregular or wrong feeding, or if the cylinder of the printing machine should miss a sheet.

Messrs. B. J. Hall & Co., of 89, Victoria Street, S.W., show electrical printing and copying apparatus specially designed for engineers' and architects' use.

One cannot leave the exhibition without mentioning the many excellent examples of gas engines, many in operation driving machinery and dynamos. Among those who are prominent in this line are Messrs. Crossley Bros., Ltd., the National Gas Engine Co., Ltd., Messrs. Kynoch, Ltd., Messrs. Tangyes, Ltd.

SUPERHEATED STEAM.

In the final discussion on Mr. Rowan's paper before the Institution of Engineers and Shipbuilders of Scotland, Prof. Jamieson drew attention to the fact that the improvement due to superheat was greater in a compound condensing engine than in a triple-expansion condensing engine, and that in a simple non-condensing engine there was still greater improvement due to the use of superheat. He derived these facts from information received from Messrs. Belliss & Morcom, and Messrs. Willans & Robinson, and he surmised that the condensing simple engine might be between the above-named compound engine and the non-condensing simple engine. He also pointed out the more rapid increase of gain for the first addition of superheat, and argued in favour of moderate superheat and reheating. He further considered that triple expansion is hardly worth while employing, and that a simple condensing engine should be equal in economy to a compound condensing.

In this argument Prof Jamieson has already been forestalled about two years ago, in an article in the Electrical Review by Mr. W. H. Booth, who called attention to the excessive cylinder proportions of compound engines when driving a traction load with a small load factor, such as must always be the case on any tramway system using less than 200 cars. He advocated the reduction of cylinder sizes, late steam cut-off for the infrequently occurring maximum peaks of load and superheat, for after all the compound engine to be economical must have a steady mean load, and it is poor economy to install a big engine for a small average load, simply that it may carry over the peaks at an expansion of four times, which is the usual minimum expansion provided for.

Turning to practical points in actual superheaters, Prof. Jamieson pointed out the danger of small-tube superheaters which burn and warp and cause dissociation of the steam passing through them with destructive oxidation of the tubes. This destructive action is, of course, inevitable without a good system of water control. Dissociation occurs a little over 700° F., showing the folly of those who talk about high superheat of 700° and 800° F. temperatures, which are impracticable. He says that Mr. Parsons objects to superheat in the new Atlantic liner turbines. Possibly Mr. Parsons objects to uncontrolled superheat.

Finally, he gives a formula for estimating the gain due to superheat. It is $E = 100 - \left[\frac{100\ H\ W}{h\ w}\right]$, where H = heat units per lb. of superheated steam measured from feed temperature; W = weight of superheated steam used per I.H.P.-hour at pressure and temperature of superheat; h and w = similar figures for saturated steam. The formula assumes a knowledge of the steam used, and is only for estimating actual economy, a somewhat supererogatory task.

Mr. Chamen exhibited a piece of a small tube superheater pipe burned to oxide, a shocking example of the cheap small tube without temperature control. It had, he said, obviously been red-hot, and it came from Copenhagen. He complained that superheat of 200° F. was now being called for, and evidently thought that this was too much for high-pressure steam, for at 200 lb. gauge pressure saturated steam has already a temperature of 387° F., and the superheat temperature would therefore be 587° F. Mr. Chamen is perfectly right here. It is unwise at present to put more than 500° F. into an engine. Unfortunately many engineers are asking for a temperature of 600° or 700°, and if advised to stick to 500°, they attribute the advice to self interest. Then they hear of some trouble occurring with excessively high superheat, and become afraid of anything above 25° of superheat. If carefully prepared figures are placed before them, they call them assumptions.

How can superheat be scientifically and soberly promoted if engineers will not learn the simple elements of heat, steam, and chemical action, and will not follow Prof. Jamieson's advice, to calculate matters out on a basis of British thermal units or calories?

Prof. Storm Bull, of Wisconsin, in a written contribution, very correctly put superheating on its true basis, discarding Rankine's statement about the value of superheat during expansion, which we know does not obtain. He also swept away the fallacy of superior value of T, and that even more erroneous idea that any benefit could arise by reason of diminished density—a fallacy, by the way, which still gains support in the columns of an engineering contemporary.

The Western professor was fully convinced of the economy to be derived from the separately fired superheater, of which there can be no doubt if fuel is not wasted by the absurd system of controlling the temperature by a huge influx of cold air, instead of by usefully employing the excess of temperature in a pre-heater of feed water, as referred to by Mr. Rowan in discussing the Cruse superheater. The latter device has a pre-heater of the feed between the furnace and the superheater, and an inner pipe of hot water to control the temperature of superheat, and prevent burning of the outer pipes, such as was complained of by Mr. Chamen. Mr. Rowan also referred to nickel steel tubes as having a life three times that of ordinary tubes; but even nickel steel cannot last long when red-hot, and ordinary steel, with an inner control tube of hot water, will last many years. There are now in use and in good condition steel tubes that have worked for five years and show no signs of deterioration. But in superheating work, intelligence is fully as much required as in boiler work.

No superheater ought to be exposed to a temperature above 1,400° F., and no tube which becomes red hot to the steam side can help becoming oxidised by the passing steam. Hydrogen gas is made thus in the laboratory, and the process of the laboratory will be repeated in the boiler house. It is high time that the nonsense talked about superheat temperatures of 750° F. was stopped, and that men should appreciate the absurdity of red hot superheater tubes exactly as they would the absurdity of working boilers at a red heat.

CORPORATION TELEPHONES.

A paper with the above title was read on April 12th before the Glasgow Local Section of the Institution of Electrical Engineers by Mr. A. R. Bennett, and was discussed at an adjourned meeting on May 10th. The paper describes in more or less general terms the technical equipment of the municipal telephone systems with which the author is connected; the descriptions somewhat lack specific character, but that deficiency is presumably covered by the author's preliminary apology for the sketchy nature of the paper. Whatever may be said of the financial and political status of municipal telephone undertakings, the paper certainly gives a sorry account of their technical features. We learn, for example, that the Glasgow Corporation exchange has a mixture of call-wire and "ring-through" operating, that in some

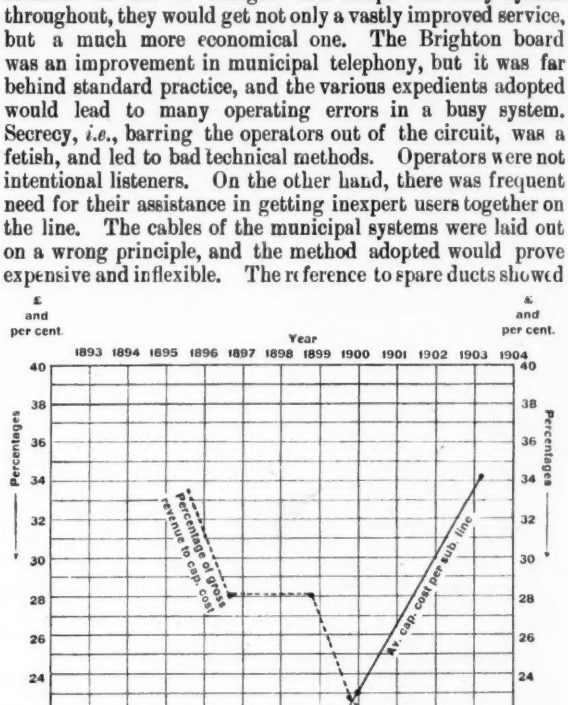
exchanges the call-wire method has been modified by the introduction of clearing-out signals, and that it is proposed to abolish the call-wire system altogether, though so far nothing to replace it has been settled on. These few remarks furnish the internal reasons for the great dissatisfaction with the Corporation service currently reported from Glasgow. In Portsmouth and Swansea the ring-through system is adopted, grid indicators, self-restoring by gravity, being used for the line signals. These signals are worked off a central battery, and the subscriber is required to keep the calling button pressed down until the operator answers. When the operator plugs in, two jack springs, forming series contacts in the line signal circuit, become separated, thus cutting off the line signal. The author considers this device superior to the usual American practice of disconnecting the line signal by means of a cut-off relay. At Brighton the ring-through system is used, but the signalling, both for calling and clearing out, is done automatically by the act of raising and depressing the switch-hook. The same series jack device as in the Portsmouth board is used for cutting out the line signal, which in this case is a drop associated with the answering-jack in such a way that the insertion of the answering plug mechanically restores the drop shutter. The signals are worked by a fleeting earth put on one side of the line, the hook being fitted with a special contact making a momentary earth as the hook rises and falls. There are two clearing-out drops, one red for the calling line, and one yellow for the called line. When the called subscriber answers, his yellow drop, of course, falls, and must be restored by the operator. Subsequently, when the two drops fall the operator takes the simultaneous display of the two as a signal for disconnection. The same system is to be used at Hull.

A few other switchboard details are described, and the author, after claiming that the flat switchboard at Glasgow saves much space, incidentally shows that to obviate the difficulty of getting at the multiple cables and jacks, the multiple cables are laid in a false flooring on either side of the board, this false flooring extending a considerable distance behind the operators' chairs; so that, arranged in this way, a flat board must occupy much more space than a vertical board.

A defence is made of the extensive use of armoured cable at Glasgow, the principal argument being that as cables laid in pipes are sometimes damaged, the duct is not an invariable protection; therefore armoured cables, which are much more easily damaged than iron ducts, are quite permissible.

The rest of the paper is filled up with descriptions of the ordinary material used in building telephone lines—wire, cable, pipes, and poles—of the dry-air method of keeping up cable insulation (which seems to be in constant operation at Glasgow), and with careful mention of the names of the majority of the manufacturers who have supplied material to municipal telephone systems. There is a description of the methods adopted to avoid electrolysis, and it is said that iron pipes are themselves a protection against electrolysis. In describing the underground work at Glasgow, the author makes some reference to the criticisms which have been made regarding the great difference between the actual cost of the Glasgow system, and the estimates on which the Corporation proceeded, as follows: "With the object of avoiding re-disturbance of streets, the Telephone Committee wisely determined to lay a very large number of spare pipes. That policy has been completely successful, as, notwithstanding the great increase which has taken place in the number of lines, it has not, so far, been necessary to reopen any important street. But, owing to the large amount of capital which has thereby been left unremunerative for a time, occasion has been given for critics to assert that the estimates have been largely exceeded; but this, when the facts are taken into account, is found to be a complete myth."

The discussion was by Messrs. Webb, Kingsbury, and Gill, and written communications were received from Messrs. Cooke and Watts, dealing with points of detail in the various switchboards described. The discussion was extremely critical, and there was very little left of the paper at the end. Mr. Webb thought that the author had paid too much attention to the promotion side of the telephone business, and had neglected to keep up to date in engineering advances; consequently the march of progress had left him behind the times. The paper was clear proof of this, as it described nothing but antiquated and disadvantageous methods. It showed that municipal telephone men were learning the business all over again by themselves. The adoption of the call-wire system in Glasgow had been a great mistake, and had led to a mixture of different methods of working, giving a bad service and an uneconomical service. The author condemned the relay system, and to avoid it used a series jack, an expedient which had many disadvantages and would cause bad service, while in a large switchboard it would cost more than a cut-off relay. The relay system was in use for a million telephones, and gave an efficient and reliable service. If they could sweep away the tangle of different methods in use at Glasgow and adopt the relay system throughout, they would get not only a vastly improved service, but a much more economical one. The Brighton board was an improvement in municipal telephony, but it was far behind standard practice, and the various expedients adopted would lead to many operating errors in a busy system. Secrecy, *i.e.*, barring the operators out of the circuit, was a fetish, and led to bad technical methods. Operators were not intentional listeners. On the other hand, there was frequent need for their assistance in getting inexpert users together on the line. The cables of the municipal systems were laid out on a wrong principle, and the method adopted would prove expensive and inflexible. The reference to spare ducts showed


£ and per cent.
£ and per cent.
Year
1893 1894 1895 1896 1897 1898 1899 1900 1901 1902 1903 1904
Percentages
Percentages
Percentage of gross revenue to cap. cost
Av. cap. cost per sub. line
Average capital cost per line
Percentage of gross revenue to capital cost

Glasgow Telephone Estimates and Actual Results.

that the important question of spare plant was not yet properly understood by the author. Surplus plant was a necessity to provide for regular growth and to provide the flexibility in the plant necessary to cope with the constant changes in the positions of subscribers. They must always have surplus plant and must recognise it in estimating cost. The effect of the spare duct on the capital cost of the Glasgow system had been over-estimated in the paper. The spare duct was only 25 per cent. of the total duct, and represented not over 6 per cent. of the total capital. To show clearly how the estimates had miscarried, Mr. Webb had plotted a curve showing the estimated cost of a Glasgow municipal subscriber's line at various times and the actual results, together with the corresponding ratio of gross income to capital cost. From £17 per line, the cost given for a Glasgow system in a paper read at Edinburgh in 1896, the average capital cost per subscriber had risen to over £34 in 1904, and the ratio of gross income to capital had fallen from 34 per cent. to 16 per cent.

Mr. Kingsbury contributed to the discussion an interesting historical account of the ring-through system, which the author claimed to have invented in 1891. The special clearing out drop, permitting the subscriber to ring without signalling the exchange, was shown to have been a stock article in America in the eighties, and a drop for this purpose

was described in a paper read before the Glasgow Philosophical Society in 1887. By reference to numerous historical documents, Mr. Kingsbury showed that a much clearer idea of the essential requirements of telephone operating was expressed in various parts of the world years ago, than was evinced in the paper under discussion. He thought that it was a duty which members owed to the Institution to discuss fully a paper which showed such a defective knowledge of the general state of the art.

Mr. Gill thought the author had jumped to a hasty conclusion in stating that an iron duct necessarily protected a lead cable from electrolysis. The cable and pipe formed a composite conductor of varying resistance in different parts, and not always in close contact. The current would sometimes leave the iron for the lead, and *vice versâ*. He had had cases of lead cables being damaged in iron pipes. The reference in the paper to the "clumsy and expensive" relay of the "usual American practice" he construed as an attack on the central battery system, which was the system adopted all over the world by the engineers having the greatest experience. He gave a list of large cities on the Continent where the central battery system had been adopted; in England the Post Office had central battery equipment for 30,000 lines, and the National Co. had similar equipment for 40,000 lines. In America last winter Mr. Gill saw central battery equipment everywhere, and found that the total capacity of such equipment installed in the United States was then over 640,000 lines. He gave figures to show that the faults on relays in four working systems amounted to one fault per relay in 50 years. The contrast offered by the general adoption of the central battery system, and the variety of systems described in the paper, was that on the one hand they had standard systems put in five years ago which were standard and up-to-date to-day, and on the other hand they had in municipal telephony, in the course of three years, a different system in each town, and even differences in the same town, as at Glasgow. Even the non-telephone expert could draw conclusions from that contrast. The conclusion he drew was that the Corporations must repair the errors of their ways telephonic, and when they awoke to the necessity of reconstructing their plants on modern lines they would have to face a great wastage.

Mr. Bennett, in reply, expressed surprise at his little paper, prepared in haste to fill a blank evening, having attracted so much attention. He proceeded at some length to enter into biographical details regarding his critics, and this occupied so much time that the meeting was adjourned before any of the technical points raised in the discussion were dealt with. He thought a great effort had been made to advertise the common battery system; he did not find that he got a very good service on that system in London, and he found the talking very variable. He had been told by an ex-inspector of the Post Office, that there were many more faults on the Post Office London system than on some Corporation systems, and by an ex-official of the National Telephone Co., that the common battery system was a passing craze, and that of two exchanges in London, one magneto and one common battery, the magneto exchange gave better service than the common battery, and was the more easy to maintain. The rest of Mr. Bennett's reply was to be communicated to the proceedings, and we hope to summarise it at a later date.

INDUCTION COIL DESIGN.

By MORTIMER A. CODD.

Every year the induction coil is coming more into use for the production of X-rays, for the propagation of Hertzian waves, for high frequency effects in electro-therapeutics, and for ignition purposes in explosion engines; yet it remains almost identical in form with the type originating with Rhumkorff in 1851. This seems largely due to the fact that until the last few years their construction has been in the hands of opticians rather than electricians, and that they have been used by physicists rather than engineers.

It is significant that the recent discoveries of Röntgen, Hertz and Tesla were made with its aid, and we may claim that it has passed from the realm of the pith ball and electroscope to that of practical electricity.

The extreme rapidity of the changes which take place in the induction coil renders quantitative measurement next to impossible, and the observations of the makers, which are almost entirely empirical, are little guide.

That the induction coil as at present constructed is an inefficient transformer there is no doubt. A 6-in. coil was tested while giving 4 in. and 6 in. sparks, the currents in the secondary being respectively ·00125 and ·00077 ampere; the input to the primary was in both cases 6 volts 6 amperes, or 36 watts, the most efficient combination (see curve, fig. 1).

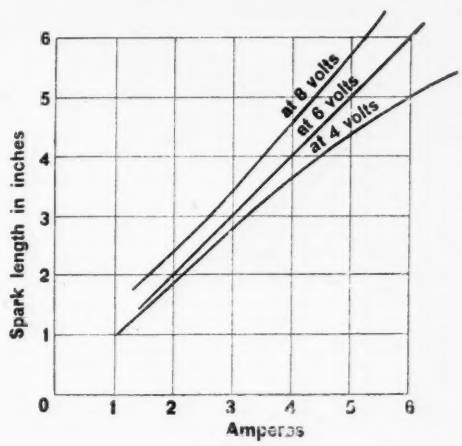


Fig. 1.

This gives an apparent efficiency in the first case of 10 per cent. and in the second of 20 per cent., but as the power factor was probably far from unity, these figures must be taken as high.

The causes of this inefficiency may be divided into the following parts:—

1. The reluctance of the air to the return of the magnetic lines.

Self-induction and resistance of the primary condenser and contact-breaker losses.

2. Great self-induction and resistance of secondary.

Inefficiency owing to distance of secondary from core due to primary and insulating tube.

Leakage of secondary.

The necessity of an air return for the magnetic lines is a fundamental essential of coils, for if the magnetic circuit is closed an alternating current is necessary to energise the iron, and if nearly closed such low frequencies have to be used (with a continuous current), that for practical purposes such coils are useless. Such coils labour, too, under the additional disadvantages of having a larger hysteresis loss, the almost insurmountable difficulties of insulation, and the fact that a separate contact-breaker has to be used.

A coil, however, with its magnetic circuit so partially closed as not to unduly facilitate the retention of the magnetic lines certainly possesses advantages.

A coil of this nature with a core $2\frac{1}{2}$ in. × 8 in., having hedgehogged ends, gave a 12-in. spark with about 6 lbs. of No. 36 wire as secondary, the whole being immersed in oil. It is highly probable that by further modifying the design, this spark length might be considerably increased.

There are probably no great hysteresis losses, as the core does not go through a cycle (unless alternating currents are used); it is simply magnetised and allowed to lose its magnetism, but there has, however, to be a certain amount of coercive force.

When the core in any way approaches the condition of a partly closed magnetic circuit (*e.g.*, by having its ends hedgehogged over) its diameter compared to its length should be made greater, because the reluctance of the iron is then more comparable with that of the air; on the other hand, for ordinary bar type cores the iron rarely approaches in magnetisation that inefficient part of the curve nearing saturation.

The best proportions dictated by theory and practice appear to show that the core should in length be twelve times its own diameter.

Generally speaking, a long coil has more self-induction in its primary than a short one, but with modern high frequency interruptions, not including the Wehnelt, this does not appear to matter, and with multi-sectional coils length distinctly improves the chances of efficient insulation.

The primary should be wound along the whole length of the core, and not in the middle; for, if the lines be plotted by means of iron filings, it will be found that the lines start on their return path from the ends of the primary coil and hardly at all from the ends of the core.

With regard to the number of layers of primary, two should be sufficient in an ordinary coil, or at most three, and with the long core mentioned above, one layer would probably be enough.

The P.D. of the secondary discharge varies almost proportionately with the number of turns of secondary, compared with the number of turns on the primary—that is, $V_s : V_p = T_s : T_p$—therefore it is an advantage to keep the primary turns low.

The P.D. of the secondary, however, also depends on the strength of the magnetism and the rate of change of the lines of force.

If more turns are put on the primary, the magnetism of the core will be increased, and with the magnetism the self-induction, so that a higher voltage would be required to work the coil, though the current might be lowered; thus a coil taking 8 amperes at 10 volts with two layers, would require 7 amperes at 12 volts with three layers. It is, moreover, remarkable that such a coil working off, say, 100-volt mains would require but 2 amperes.

Again, the more the layers of primary added, the further is the first layer of the secondary from the core, and the smaller the number of lines of force linked by the secondary; the condenser, too, has to be made larger to stop sparking at the interrupter.

A word might here be said about the function of the condenser. It is too generally taken for granted that the condenser is simply used to "absorb the extra current" from the primary. Though this is doubtless true, there may be another effect which attends the charging and discharging of all condensers, that is, rapid oscillations are set up between the two condenser plates through the primary (and battery) when the self-induction of the one and the capacity of the other are balanced, and it is when this condition is fulfilled that the best results are obtained.

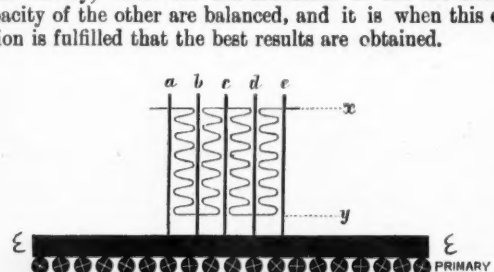


FIG. 2.

This result has always been arrived at experimentally, for it is known that if the condenser is too small, the secondary spark is short and feeble, and if too large, the spark is short and thick, also that if in a balanced coil there is an additional self-induction introduced into the condenser circuit, the secondary spark rapidly falls off, showing clearly that the charging of the condenser partakes of an oscillatory nature.

It has already been shown by Mizuno that the larger the current passed the greater should be the capacity of the condenser, and bearing these results in mind the desirability of an adjustable condenser seems clearly demonstrated, particularly as when the secondary is closed the self-induction of the primary is reduced, and *vice versâ*.

It has been urged that in Lord Rayleigh's pistol shot experiment, in the vacuum and electrolytic interrupters, and in the wheel air-blast breaks, no condensers are used. The explanation of this apparent anomaly may be that at high frequencies a very small capacity would suffice, which might be furnished by the layers of primary, or the plates of the accumulator or battery.

Secondary windings may be divided into two classes, cylinder and sectional, or a combination of the two.

In fig. 2 is diagrammatically set forth the winding of a sectional secondary. Let *a*, *b*, *c*, *d*, *e*, represent ebonite partitions $\frac{1}{8}$ in. apart. The secondary is wound in between these partitions by any fortuitous plan that may commend itself to the maker, and should one of the outer wires slip down and form a chord to the circle (as often happens) that part of the section is short-circuited and rendered inoperative, with the risk also of burning through the wire.

Putting these considerations aside, however, and imagining each section perfectly wound, it is clear that the distance between the top *x* and the bottom *y* of the winding from the tops and bottoms of the partitions *a*, *b*, *c*, &c., must be greater than the sum of the spark lengths of any two sections.

For instance, suppose each section gives $\frac{1}{8}$-in. spark, then the distance between *x* and the outer edges of *a*, *b*, *c*, &c., and *y* and the inner edges of *a*, *b*, *c*, must not be less than $\frac{1}{8}$ in., because the two sections together give a $\frac{1}{4}$-in. spark; that is, the first turns of the secondary must be more than $\frac{1}{8}$ in. from the ebonite tube ε, which is, in itself, a fair distance from the primary and core; also the greater the spark induced in any two sections, the further must the first turns be from the core. The height of the winding between *x* and *y* must, of course, exceed the maximum spark length of the section.

The partitions *a*, *b*, *c*, *d*, *e*, therefore, should be as narrow as possible, and the distance between the first section of the coil, *a*, *b*, and the last, *d*, *e*, must be rather greater than the maximum length of spark given by the coil. This has been accomplished in the jointless-wound multi-section coils, in which each partition contains but one flat spiral of wire.

It is obvious that the ebonite tube, besides adding to the inefficiency of the coil by increasing the distance between the secondary and the core, has to withstand at each end one-half the maximum P.D. of the coil, and should one end of the secondary, by chance or design, become earthed, it would have to withstand the whole pressure, with the liability of piercing.

Again, the ebonite tube has to be made considerably longer than the secondary, for the sum of the lengths of the ebonite tube between ε, *a*, and ε, *e*, must, for safety, be longer than the maximum spark length of the coil.

(*To be concluded.*)

TRAMWAY PERSONNEL.

As the managers of the more important tramways in the United States have made such an important point of the selection, training, and future disciplining of their employés, it is only natural that the now Anglo-American *Street Railway Review* should take an early opportunity to sound English managers on the same point. The result is meagre, and we do hope that it does not represent the real state of affairs. The managers of the Dublin United and the City of Birmingham Companies, and of the Glasgow, West Ham, and Bath Corporation Tramway Departments contribute to the March issue, and we have found that Mr. Gordon and Mr. Young are the only ones who have realised the full scope of the inquiry. Mr. Conaty deals solely with the training of motormen as emergency linemen; Mr. Carter, of Bath, remarks in nine lines that certain bonuses are given to motormen for freedom from accidents, and to conductors for freedom from peculation; while Mr. Blain, of West Ham, spoils an article, which deals almost entirely in its readable portions with discipline, by an excess of unnecessary detail.

Our readers know how we have striven to drive home to English managers the prime necessity for careful selection and strict training as the most important factors which go towards making a tram service most beneficial to the owners and the public; but we regret to say that the seed has not fallen on good ground as yet, for the number of undertakings which have developed or adopted a definite and complete system is disheartenningly few.

The size of the system matters nothing. Managers of a five-mile run should not think that the smallness of the business and the insignificant pay-roll, make the selection or the training of their staff any less important relatively than they are on a system inter-threading a city. Within

certain limits the percentage of undesirable applicants is the same, and the percentage of untrainable men will be the same. It is the percentage that matters, not the numbers.

Much has been said of late about the percentage of rejected applicants for service in the Army. We do not remember this to have exceeded 60 per cent. in the worst case, but Mr. Young finds that no more than 10 per cent. of the applicants actually enter the service of the tramway department; as many as 75 per cent. being rejected practically at sight, and the remaining 15 per cent. later.

The average wages of both motormen and conductors, but especially of motormen, is quite high enough to attract a superior class of man, and it is simply the fault of the manager if he is content to pay the rates commanded by skilled labour for morally or physically-degenerate men.

A lot of the trouble lies, no doubt, in the fact that managers of the type often found in small undertakings seem to have a poor idea of what a man should be. Their powers of instinctive selection are weak, and, in consequence, their standard is low. It is an astonishing truth, too, that not a few men who cannot understand why their staffs are always in trouble, either do not make any attempt to trace the antecedents of applicants, or place little value on references.

No matter how steady and upright a man may be proved by his references, he should not be considered fit to enter for training either as a motorman or as a conductor, until he has passed the doctor. There is an extraordinary repugnance to this medical examination amongst managers, or if not repugnance, no definite sense of the value of this vital test, and we can think of no better agents for the education of directors and committees, who maybe are even more at fault in this respect than their managers, and who, being converted, will make short work with the manager's scruples, than the various companies which insure against third party and employers' liability claims. These companies have a direct interest in the mental balance and physical soundness of the men for whose actions they so frequently have to pay, and more attention to this matter at an earlier date might have made it unnecessary for them to keep on raising premiums and narrowing policies, until the former have risen to such a crippling height that many concerns find it better to effect private or mutual assurance.

Associated with most tramways, or groups of tramways, is a sick benefit club for the workmen. Before entrance to this can be gained, it is usual for the candidate to have to undergo a medical examination. We know that a very vague, but almost ineradicable, fear of what the omniscient doctor is going to do, possesses in general the class of man for whom these sick clubs are instituted, and, as insurance companies can witness, not alone that class, but many of the class that ought to know better.

This terror of the uncultured imagination is responsible for the lamentable fact that the membership of clubs which insist on examination (however cursory that may be in reality) often does not bear a sufficiently heavy ratio to the number of employés. As the success of a sick club, as of an insurance company, depends on the number of its members, the officials of tramway undertakings which contribute as a rule to the clubs, are confronted with a temptation to boost the membership to the maximum by compulsory methods.

Compulsion is generally synonymous with tyranny, and should be avoided. It is too often the first resort of the weak ruler. But, where there would be many arguments against compulsory membership of a sick club, involving compulsory medical examination, there can be few against making every applicant for employment pass the doctor; the primary object being to keep out the physically unfit, but an important secondary result being obtained simultaneously by removing the necessity for another visit to the doctor before gaining admission to the sick club. The act of enrolment on the pay-sheet thus makes a man eligible for the sick club, and if the membership does not increase under those circumstances, then it will be time for the trustees to consider either their stability or the scale of benefits, or the methods in use for enticing new members.

Having chosen your man, it remains to train him, and no better means for doing this can be found than those adopted or devised in Glasgow. The full curriculum is expensive, but it may be modified to suit the size of the undertaking. In too many cases the period of training is looked on by the management as so much waste of time, and anything deeper than driving for a week, or perhaps a fortnight, under the direction of a motorman who has been "trained" in the same way, is considered unnecessary for any learner.

After catching and breaking comes the hardest task of all, because in its issue is involved the play of human nature, the variables of temperament.

There is a three-fold but single problem before the manager. He has to keep his man, to keep him good, and to keep him contented. If he is not successful we may be fairly certain that the fault is his own, assuming of course that he has a free hand, and is not like the late unfortunate at a Metropolitan Borough who owned to 48 rulers. The secret of success is concealed within the two words—encouragement and discipline, and for both the gracious quality of sympathy is essential.

Touching these matters, what better advice can there be than that given by the immortal Don Quixote de la Mancha to his henchman Sancho, when the latter was appointed Governor of the Island of Barataria?

> **Never pronounce judgement rash or wilfully, which is very frequent with ignorant judges, that presume to be skilful. . . .**
>
> **Make not many statute laws; and those thou dost make, see they be good, but chiefly that they be observed and kept; for statutes not kept are the same as if they were not made, and do rather show that the prince had wisdom and authority to make them than valour to see that they should be kept. And laws that only threaten, and are not executed, become like the Beam, king of frogs, that at first scared them, but in time they despised, and got upon the top of it.**

Good results can be obtained no more from the human machine than from the mechanical without the taking of pains. Great pains in the selection of material, in the shaping of it, and in the setting to work. Constant pains, but less intense, in the guidance and continued work.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION (NORTHERN SECTION).

The annual general meeting was held at Leeds on Saturday, May 14th. Mr. E. C. Wallis (Leeds) presided, and representatives from Newcastle, Leeds, Huddersfield, Blackburn, Manchester, Stockport, Liverpool and London were present. Mr. Wallis moved the adoption of the annual report and balance-sheet for the sixteen months ending April 30th, 1904.

Election of officers for the ensuing year then took place, as follows:—

Chairman, Mr. J. McDermott, Manchester; *Vice-Chairmen*, Mr. E. C. Wallis (*ex officio*), Leeds, Mr. S. H. Gowdy, Newcastle, Mr. W. Sutton, Liverpool, and Mr. E. T. Steinthal, Manchester; *Hon. Secretary*, Mr. W. Cross, Newcastle; *Hon. Treasurer*, Mr. T. G. Usher, Newcastle; *Hon. Auditors*, Messrs. S. H. Gowdy and J. Andrewes, Newcastle; *Hon. Solicitor*, Mr. R. Tweedy Smith, of London; *Representatives to the Central Board*, Messrs. J. McDermott, E. C. Wallis, W. Cross, G. H. Harford.

Mr. Wallis having vacated the chair, Mr. McDermott took his place and gave a short address, referring to the good work done in the past year, and hoping for good results in the ensuing year, under the new scheme of reconstitution. Reports were presented from the various local branches, showing that quiet but useful work was being done in each district. The Manufacturers' Agreement was referred to, and members were specially appealed to, not to contract out of the terms of the agreement with regard to the preferential discount, but to insist on its universal application. The Workmen's Registration Scheme and the Rules for Workmen were reported on, and gave rise to a short discussion, leading on to the question of apprenticeship, and the education of workmen generally.

Suggestions were made for the formation of correspondence classes, and the issuing of a small technical handbook or periodical for the use of the men employed by the Association, so as to offer better training than some of the correspondence classes (sometimes very harmful) so freely advertised at the present day. Mr. Cross read one or two samples of the extraordinary style of teaching given by this system, which were remarkable for their extravagant inaccuracy and ignorance. It was also suggested that an education committee should be formed to act in conjunction with local education authorities.

A survey of the results of opposition to the abuse of municipal trading was presented, and led to discussion as to how far such trading was advisable. It was generally felt that the growth of municipal debt and trading, to the detriment of the private enterprise of the ratepayers, was not to be commended, but that if due care were taken by the Association when Bills came up for consideration, clauses could be inserted which would enable the corporations to promote free or assisted wiring, so long as the work was done through a *bond fide* electrical contractor. The "Ealing Clause" was cited as an example of this, and reference was made to the fact that this clause had been successfully introduced elsewhere. If this clause were not inserted, strenuous opposition should

be offered to the Bill. Reference was also made to the right possessed by any ratepayer of demanding a poll on the question of any proposed extension of powers, and also to his right to challenge any item of expenditure before the public auditor, and have unauthorised payments surcharged to the committee that sanctioned them.

Mr. Rawlings (London) introduced the "Standard Specification for Wiring of Buildings from Supply Mains," which was in the press, and would shortly be issued to members, being copyrighted for the use of the Association. This specification was the result of careful consideration by a committee which included a consulting engineer and the editor of one of the technical papers, and it would probably bring about a great saving of time to members. Liverpool was arranged as the next place of meeting, the date being left to the discretion of the executive.

Votes of thanks to the retiring and present chairmen concluded the business. An extraordinary general meeting was then held to discuss the new memorandum and articles of association of the Electrical Contractors' Association (Incorporated).

Mr. Tweedy Smith introduced the question, and explained the main outlines of the scheme, showing that the new Association was to be a company limited by guarantee, and was to be formed to take over the work of the National Electrical Contractors' Association (Unincorporated), so as to allow of more effective control and representation, and to enable the Association to take legal and Parliamentary action in advancing its objects.

Provision had been made for wide powers dealing with arbitration, education, examining and granting certificates, publishing papers, and establishing offices and reading rooms, &c. The liability of each member would be limited. There would be a paid secretary, selected for ability in opening out new districts and organising the new departments of the work.

A resolution adopting the memorandum and articles of association, and providing for the merging of the present Association into the new incorporated one, was passed by a unanimous vote, and the chairman and vice-chairman were instructed to sign as original subscribers on behalf of the Association. This closed the proceedings.

NEW PATENTS APPLIED FOR, 1904.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

10,019. "Improvements in dynamo-electric machines." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) May 2nd.

10,036. "Improvements in and connected with electric cables." A. Berlin. May 2nd. (Complete.)

10,058. "Improvements in electric switches." The General Contracts Co., Ltd., E. S. Cook and W. H. Chipperfield. May 2nd. (Complete.)

10,070. "Improvements in or relating to regulating sockets for electri lighting, heating or power purposes." L. F. Bodia, Jun. May 2nd.

10,073. "Improvements relating to electric telegraphy." S. G. Brown, May 2nd.

10,079. "An improved electric system and means for directing the training of searchlights and the like." W. D. Kilroy. May 2nd.

10,080. "An improved system and apparatus used therein for the dis tribution of electrical energy over a large sub-divided area." A. E. Tanner May 2nd.

10,081. "Improvements in electric meters." R. F. Venner. May 2nd.

10,119. "An improved method of and means for adapting electric candle to sconces and the like." C. C. Regnart. May 3rd.

10,133. "Improvements in sparking plugs for internal combustion engines.' C. J. Mayhew. May 3rd.

10,142. "Improvements in and relating to electrical conductors." P. A. McGeorge. May 3rd. (Complete.)

10,147. "An improvement in the provision of an automatic electric brak on cars operated by electricity from an outside source of current." J. Sayers May 3rd.

10,171. "Improvements in means for regulating the secondary current produced by direct current converters." R. A. Muller. May 3rd. (Complete.)

10,172. "Improvements in dynamo-electric machines." O. Imray. (Bullock Electric Manufacturing Co., United States.) May 3rd. (Complete.)

10,173. "A combined electric switch and plug connector." May 3rd (Complete.)

10,182. "Improvements in or relating to means or apparatus for conveying current to electrically propelled vehicles on railways." C. H. Merz and A. H. Marshall. May 3rd.

10,183. "Improvements in or relating to current collecting apparatus and overhead frogs for use with electrically operated tramway and railway vehicles." C. H. Merz and A. H. Marshall. May 3rd.

10,210. "Improvements in electric traction on a shallow conduit system." S. G. Bennett. May 4th.

10,229. "An improved life-guard or saving car, to be attached and driven forward or reversible for electric tramcars, steam cars, engines, or any other locomotive driven on roads, rails, or metals." J. S. Bailey. May 4th.

10,242. "Improvements in high-tension electric current switches." The British Thomson-Houston Co. (The General Electric Co., United States.) May 4th.

10,243. "Improvements in vapour electric apparatus." E. A. Carolan. (The General Electric Co., United States.) May 4th.

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10,249. "Improvements in vapour electric apparatus." E. A. Carolan. (The General Electric Co., United States.) May 4th.

10,250. "Improvements in vapour electric apparatus." E. A. Carolan. (The General Electric Co., United States.) May 4th.

10,276. "Improvements in electric block signal systems." T. Silvene. May 4th. (Complete.)

10,308. "Improvements in the method of and means employed for supporting and connecting the trolley wires of overhead electric systems." J. Haydock and T. S. Jones. May 5th.

10,341. "Improvements in vapour electric apparatus." E. A. Carolan. (The General Electric Co., United States.) May 5th.

10,356. "Improved construction of mounting of trolley-arms for collecting electric energy from overhead cables for electric traction." E. B. Phillips and T. C. Parkin. May 5th.

10,370. "Improvements in or relating to secondary or storage battery plates." A. J. Boult. (C. Potter, United States.) May 5th. (Complete.)

10,393. "Electro-medical apparatus." H. I. W. Schwedler. May 5th. (Complete.)

10,406. "Improvements in and relating to sparking plugs for electric ignition for internal combustion engines." F. T. Reid. May 6th.

10,429. "Improvements in or connected with electric incandescent lamps." W. McAuslane. May 6th.

10,430. "Improvements in electric cables." A. Whalley and E. A. Bayles. May 6th. (Complete.)

10 448. "Improvements in electric ignition coils and the like." H. Halford, E. Shouls and S. Bridgwater. May 6th.

10,455. "An improvement in elevated structures for communication by railway, tram or other means in cities, for affording facilities for the distribution therein of water, gas, electricity, power, heating, lighting, cooling and the like; the transport of goods, materials, messages, and the like by pneumatic tube or other means and for communicating by wire or wires." J. Struthers. May 6th.

10,456. "Improvements in and relating to electric switches." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) May 6th.

10,457. "Improvements in and relating to alternating-current electric motors." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) May 6th.

10,458. "Improvements in and relating to alternating-current electric motors." The British Thomson-Houston Co., Ltd. (The General Electric Co , United States.) May 6th.

10,459. "Improvements in electric control systems." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) May 6th.

10,460. "Improvements in and relating to electric switches." The British-Thomson-Houston Co., Ltd. (The General Electric Co., United States.) May 6th.

10,461. "Improvements in multiple switch rheostats." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) May 6th.

10,488. "Improvements in earthing devices applicable to lightning arresters and the like." I. B. Birnbaum and F. G. Bell. May 6th.

10,492. "Improvements in electrical measuring instruments." D. M. K. Edgcumbe and E. I. Everett. May 6th.

10,502. "Improvements in prepayment electricity meters." R. C. Griesbach. May 7th.

10,503. "Improvements in trolley wheel spindles for electric tramway cars." W. A. Entwistle. May 7th.

10,525. "An improved driving gear for electrically-driven rotary brushes. J. Maclean. May 7th.

10,575. "Improvements in and relating to type printing telegraphs." E. J. Steljes. May 7th.

10,551. "Improvements in the arrangement of electric motors in or on electrically-driven vehicles." F. Krizik. May 7th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1903.

Trolley Electric Tramways. G. Hall. 25. January 1st.

Electro-magnetic Apparatus. Siemens Bros. & Co., Ltd., and L. M. G. Ferreira. 70. January 1st.

Electrical Reminder Clocks. G. C. Marks. (Communicated.) 871. January

Electric Arc Lamps. The British Thomson-Houston Co., Ltd., and E. J. Murphy. 896. January 13th.

Electric Ignition Apparatus. Sir O. J. Lodge and A. M. Lodge. 2,162. January 29th.

Electrostatic Apparatus for Relay and Other Recording and Operating Purposes. G. D. Rung and D. la Cour. 2,112. January 28th.

Electric Distribution Systems. A. J. Boult. (The Osborn-Morgan Co., United States.) 2,256. January 20th.

Combined Electrical Switches and Electro-Magnetic Cut-outs. R. W. Bill and F. W. Abbott. 2,343. January 31st.

Electric Arc Lamps. F. M. Lewis. 2,609. February 3rd.

Telephonic Transmitters. W. E. Heys. 2,713. February 5th.

Cars for Trolley Wires of Electric Tramways. C. Close and J. Ramsey. 2,857. February 6th.

Electric Tramway Systems. R. Zuppinger. 2,928. February 7th.

New or Improved Devices for Indicating the Stopping Places of Electric Tramcars, applicable also for other Purposes. I. Boulton. 3,102. February 10th.

Apparatus for Making Coils for Electrical Apparatus. E. A. Carolan. (The General Electric Co., United States.) 3,158. February 10th.

Electric Brakes for Cars. R. W. James. (The Algonquin Electric Brake Co., United States.) 3,170. February 10th.

Hangers for Overhead Trolley Wires. A. Richardson and W. H. Allen. 3,226. February 11th.

Electrical Ignition Apparatus applicable to Internal Combustion Engines. A. Eckstein and H. J. Coates. 3,244. February 11th.

Electrotype Blocks. J. W. Cornelius. 3,396. February 13th. (Date claimed under Patents Act, 1901, February 13th, 1902, being date of application in United States.)

Controlling Electric Circuits. H. Leitner and R. N. Lucas. 3,425. February 13th.

Luminous Vapour Electric Lamps. G. L. Hogan. 3,603. February 16th.

Regulating Devices for Electrically-Propelled Vehicles. J. S. Raworth. 3,657. February 16th.

Motors and Regulating Devices for Electrically-Propelled Vehicles. 3,658. February 16th.

Electric Light Safety Relay. A. H. Johnson and F. R. S. Bircham. 3,783. February 18th.

Contact Stud and Fixing for Use with Surface Contact Systems of Electric Traction. W. Griffiths and B. H. Bedell. 3,888. February 18th.